

# ***Economic Assessment of the Bradfield/Iskut Transportation Corridor***

***PREPARED FOR:***

***Alaska Department of Commerce,  
Community & Economic Development***



Research-Based Consulting

Juneau  
Anchorage

***November 2004***

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***PREPARED BY:***



***Juneau • Anchorage***

***In association with:***

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## ***EXECUTIVE SUMMARY***

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The purpose of this study was to identify the potential industry and community benefits associated with development of the Bradfield/Iskut transportation corridor. Further, this study compares those potential benefits with construction and maintenance/operations costs, providing a broad indication of the project's overall economic viability.

Development of the Bradfield/Iskut transportation corridor would include construction of 63 miles (101 km) of new road and reconstruction of 23 miles (37 km) of existing road. From the head of Bradfield Canal, the road would run up the Bradfield River Valley 28 miles (45 km) to the Alaska/BC border, down the Craig River valley in British Columbia, then along the Iskut River to Highway 37 at Bob Quinn. The 58-mile (93 km) Canadian portion of the road would utilize 23 miles (37 km) of the existing Eskay Creek mining road.

Access to the Bradfield/Iskut road from Alaska would require construction of a ferry terminal in Fools Inlet with regular shuttle ferry service to and from Bradfield. In the longer term, a road connecting Bradfield and Ketchikan would provide that community with a link to the continental highway system.

This analysis differs from many public transportation-related benefit/cost studies in that most of the potential benefits are tied to industrial/commercial activity rather than to personal vehicle travel. In fact, the design standard for the road is based on average daily traffic of less than 400 vehicles. Therefore, rather than focusing primarily on the benefits to a known travel market, the analysis focused extensively on the much more speculative potential for resource and other industrial development-related benefits. This, of course, adds uncertainty to the analysis and its conclusions. Nevertheless, this study is an effort to compile the best available information on how industry might respond to transportation development in the area, and to the extent possible, quantify potential benefits.

It is also important to understand that potential benefits are examined in the context of full implementation of the broader Southeast Alaska (also referred to as Alaska's "Panhandle") regional transportation plan, including highway access to Ketchikan, direct ferry service from Prince of Wales Island to Bradfield, and other regional ferry and roadway transportation improvements.

Construction cost estimates used in the benefit/cost calculations are the best available data at the time of this study. Data from Western Federal Lands Highways Division is preliminary and subject to revision pending additional work on tunnel costs. The Alaska Department of Transportation and Public Facilities will also be preparing construction cost estimates. When the ADOT&PF estimate is available, a supplement to this report will be prepared, summarizing the benefit/cost implications of the new cost data, if different than presented in this report.

Key study findings are summarized below.

## **Industrial Benefits**

### **Mining**

- Construction of the Bradfield/Iskut road would benefit the mining industry in several ways. Improved access to the richly mineralized Iskut River Valley and surrounding areas would reduce exploration costs, costs associated with mine development, and cost of mine operations.
- There is the possibility that two large-scale mines (Galore Creek and Red Chris) could come on line over the next ten years and will produce hundreds of thousands of tons of concentrate for shipment to overseas smelters. The Bradfield/Iskut road could provide mine developers improved access to tidewater, potentially resulting in millions of dollars in annual savings. These savings would be offset to some degree by the cost of port development and operations in the Bradfield Canal.
- In the *Independent Technical Report for the Galore Creek Property*, prepared for SpectrumGold by GeoSim, Inc., of Vancouver, BC, the report's authors state "if constructed, this [the Bradfield] route would have enormous impact on the viability of any local mining operations in the area, including Galore Creek."

### **Forest Products**

- Construction of the Bradfield/Iskut road would improve access to timber stands in the Iskut valley and could spur additional harvests. An annual harvest of 30,000 m<sup>3</sup>/yr (13 million board feet, mmbf) with a gross value of \$3.8 million is predicted to stem from improved access to the area.
- In Alaska, road construction could spur timber harvests along the road corridor. This analysis assumes that improved access would stimulate a harvest of 5 mmbf annually from the valley for five years, resulting in 25 mmbf total harvest. This timber would be processed by Southeast mills and would generate a total direct economic value for Southeast Alaska of \$1.5 million annually.
- With road construction, timber stands in the Iskut Valley could provide feed stock for BC mills as well as Southeast Alaska sawmills. Mills in Southeast continue to struggle with timber supply shortages. There is an effort underway to develop a more integrated forest products industry in Southeast, centered around a manufacturing facility (a medium density fiberboard plant, for example) which utilizes lower-grade logs and mill residuals. The challenge is in securing a large and predictable enough timber supply to attract the private financing necessary to build such a facility (and to allow the plant to achieve an economic scale of operations). It is possible that Tahltan harvests (and other harvests that have no export restrictions) could be one component of that timber supply base.

### **Seafood Industry**

- The Bradfield/Iskut road will provide Southeast Alaska seafood processors improved access to fresh fish markets. Fresh fish demands higher prices in



the marketplace. Higher prices mean more income for processors and fishermen.

- The benefit of improved access to the continental highway system for Wrangell, Petersburg and Ketchikan processors is estimated at \$1.5 million annually initially, increasing to over \$3 million by the end of the study period. Prince of Wales and Petersburg processors could also benefit from improved access.

### **General Freight**

- It is calculated that approximately 15,000 tons of general cargo would move on the Bradfield/Iskut road annually, as freight diverts from more expensive or less timely transportation modes. This would roughly translate into the equivalent of 1,500 truck loads. These freight traffic estimates do not include any traffic that might be generated by resource development in the Iskut or Highway 37 corridors.
- Over time and after the Ketchikan Access project is completed (the road to Bradfield), freight traffic on the Bradfield would increase – to a total annual freight volume of approximately 55,000 tons, or the equivalent of about 5,000 truck loads per year.

### **Electric Intertie Benefits**

- The Bradfield/Iskut road corridor would reduce construction costs, if an interconnection between Coast Mountain Hydro and the Thomas Bay Power Authority were to be constructed following completion of the road. The road would provide easier access, reduce the costs of staging equipment, and reduce costs of hauling in power poles and conductors. It would also minimize the need for building construction roads and using airlifts.
- An Alaska/BC interconnection via Bradfield could potentially benefit both regions. The road could allow Alaska to be connected to the North American grid and lead to better utilization of transmission capacity to BC Hydro's system.

### **Household Travel**

- Diverted and induced traffic on the Bradfield/Iskut road is predicted to total 90 AADT initially, increasing to 245 AADT following construction of the Ketchikan/Bradfield road, and to 345 AADT by 2034. Without Ketchikan Access, Bradfield traffic would be lower, at 110 AADT in 2016 and 155 AADT in 2034.
- Total economic activity associated with household travel in the Bradfield/Iskut and Highway 37 areas would be approximately \$2 million in 2011, \$6 million in 2016, and \$9 million annually in 2034. These estimates assume Ketchikan Access is in place by 2016. In the absence of Ketchikan Access, Bradfield-related spending would total \$2.3 million in 2011, \$2.7 million in 2016, and \$4 million annually in 2034.

### Diverted and Induced Bradfield/Iskut Road Traffic

	2011	2016	2034
<b>With Ketchikan Access</b>			
Diverted Traffic	50	110	155
Induced Traffic	40	135	190
<b>Total</b>	<b>90</b>	<b>245</b>	<b>345</b>
<b>Without Ketchikan Access</b>			
Diverted Traffic	50	65	90
Induced Traffic	40	45	65
<b>Total</b>	<b>90</b>	<b>110</b>	<b>155</b>

## Community Impacts

The Bradfield/Iskut road would have a variety of economic impacts in Alaska and BC including benefits to Wrangell, Ketchikan, Petersburg and other Southeast Alaska businesses and households. Alaskans would have improved access to the continental highway system, and similarly, non-Alaskans better access to Southeast.

### Wrangell

- The Bradfield/Iskut road would have greatest immediate impact on the community of Wrangell. The community would see an increase in visitor traffic as well as increased value in its seafood industry, as more product is sold on the fresh market as a result of better access. The local sawmill could also have enhanced access to timber supplies.

### Ketchikan

- With construction of the road linking Bradfield to Ketchikan, that community would experience the same type of economic benefits as Wrangell: increased independent visitor traffic, higher-value fish production, timber industry benefits, and enhanced household travel opportunities associated with connection to the continental highway system.

### Petersburg

- Petersburg's large seafood processing industry could take advantage of additional access to fresh fish markets. This could result in greater earnings for local processors and local fishermen.

### Other Southeast Alaska Communities

- Other Southeast Alaska communities could also benefit from the Bradfield/Iskut corridor. Prince of Wales Island residents may have direct access to Bradfield with InterIsland Ferry Authority (IFA) service.
- Communities such as Petersburg and Sitka could also benefit, to the extent that regional ferry service provides affordable and convenient access to the road.

## **Stewart**

- Stewart may have the most at stake in terms of resource transportation to and from the Cassiar region. Development of the Bradfield/Iskut road would not draw any current industrial activity away from Stewart. However, over the long-term, private developers might consider investment in alternative facilities that provide more immediate access to tidewater. To the extent that developers choose to invest in such facilities elsewhere, Stewart would experience an “opportunity cost.”
- As with other communities in the Highway 37 region, Stewart could expect some increased visitor traffic, resulting from improved Alaskan access to the continental highway system.

## **Other BC Communities**

- Vehicle traffic in the Highway 37 and Highway 16 areas would be expected to increase with construction of the Bradfield/Iskut road. Increased Alaskan travel initially, and increased BC resident travel with completion of Ketchikan Access, would result in greater spending with businesses providing goods and services to visitors.
- The community of Prince Rupert could expect to see some decline in AMHS traffic with completion of the road, as traffic is diverted to the Bradfield/Iskut road. Van traffic would likewise be affected. However, with construction of the Ketchikan/Bradfield link and initiation of daily ferry service between Ketchikan and Prince Rupert, an overall increase in traffic would be expected. Movement of coal, containerized freight and other commodities through Prince Rupert would not be affected by the Bradfield/Iskut road.

## **Tahltan First Nation**

- The Tahltan First Nation could benefit in several ways from development of the Bradfield/Iskut road. Tahltan business interests could participate in the construction of the road on the BC side, as well as in road maintenance (Tahltan Nation Development Corporation has a contract to maintain the Eskay Creek road).
- The Tahltan would also benefit by improved access to timber resources in the Iskut area. The Tahltans have a license to harvest 50,000 cubic meters of timber. Improved access to the Iskut area and improved access to tidewater would enhance the economics of timber harvests.
- The Tahltan region would also benefit economically by increased visitor travel through the Cassiar region, resulting in increased spending with visitor-related businesses.

## **BC Resident Employment Opportunities**

- To the extent that construction of the Bradfield/Iskut road stimulates resource development that would not otherwise occur, residents of

communities in the Highway 37 area could benefit from new employment opportunities.

### Corridor Development Costs

Total construction costs for the Base Case are estimated at \$340 million (in 2004 US dollars). Annual operating and maintenance costs are estimated at \$1.4 million (this assumes the Bradfield ferry and terminal are operated on break-even basis). These costs are based on construction of a paved, two-lane highway designed to American Association of State Highway and Transportation Officials (AASHTO) standards for rural collectors. Costs also include a dedicated ferry operating between Fools Inlet near Wrangell and Bradfield.

Corridor costs are summarized in the following table.

**Summary of Construction and Maintenance/Operating Costs  
Bradfield/Iskut Corridor, Base Case**

	Construction Costs (US \$)	Annual Operations/Maintenance Costs (US \$)
US Road (28 miles, 45 km)	\$247.0 million	\$0.6 million
Canadian Road (68 miles, 109 km)	67.0 million	0.8 million
Bradfield/Fools Inlet Ferry	14.0 million	*
Bradfield Ferry Terminal	12.3 million	*
<b>Total Cost</b>	<b>\$340 million</b>	<b>\$1.4 million</b>

\*It is assumed that revenues will cover the cost of ferry operations and related terminal operations. The SATP assumes a surplus of approximately \$400,000 annually.

In the Base Case, costs for the US portion of the road include construction from first tidewater, in the vicinity of the Tyee hydroelectric power plant barge landing. Other locations are potentially superior in terms of marine terminal location, though more costly in terms of road access due to difficult terrain. Total US road construction costs, including access to other potentially feasible port sites, are summarized in the following table.

**Summary of US Road Construction Costs Options,  
by Terminal Location**

	Total Construction Cost (\$US)
Tyee Hydro	\$247 million
Kapho Mountain	\$267 million
Duck Point	\$358 million

U.S. road construction cost estimates were developed by the Western Federal Lands Highway Division of the Federal Highway Administration (WFLHD). The City of Wrangell and U.S. Forest Service cooperated in the WFLHD study.

Construction cost estimates for the U.S. portion of the road include a 25 percent contingency, while estimates for the Canadian side include a 30 percent contingency.

### Corridor Development Timing

- The timing of corridor development includes a three-year environmental impact study process and a six-year construction window. In this study it is assumed that the first traffic (mainly industrial) would travel the corridor in 2011 (when at least a resource-standard road is complete), and that the corridor is fully developed (including ferry service) by 2014.

### Economic Analysis

This study has identified approximately half a billion dollars in potential benefits linked with development of the Bradfield/Iskut transportation corridor. Development costs could range from \$340 million to \$450 million. The overall economic viability of the project depends on the timing of costs and benefits and other factors.

- Economic analysis conducted in this study included net present value and benefit/cost ratio. When comparing future benefits versus future costs, the rate at which costs and benefits are discounted to a present value is critical. Using a discount rate of 3 percent results in a project net present value of just under \$110 million and a benefit/cost ratio of 1.6 to 1.
- At a discount rate of 5 percent, the project is slightly better than break-even, with a benefit/cost ratio of 1.1.
- At 7 percent the net present value falls below zero and the benefit/cost ratio below 1.0.

#### Net Present Value and Benefit/Cost Analysis Bradfield/Iskut Transportation Corridor

Discount Rate	Present Value of Benefits (millions)	Present Value of Costs (millions)	Net Present Value (millions)	Benefit/Cost Ratio
3 percent	\$300	\$192	\$108	1.6
5 percent	\$215	\$196	\$19	1.1
7 percent	\$160	\$187	\$-27	0.9

### Risks

- The costs of developing the Bradfield/Iskut transportation corridor, including road, tunnel, ferry, and marine terminal, are potentially high. The potential benefits are similarly high. While cost estimates for the U.S. portion of the road are based on detailed survey data and on-the-ground investigation (and therefore likely accurate), there is much higher uncertainty about Canadian construction costs and construction costs associated with marine terminal development in Bradfield Canal (neither of which have been the subject of on-site study). Project risks include the possibility of higher costs than assumed in this study.

- An additional risk is the possibility that industry activity in response to corridor development might not be as predicted in this study.
- Project risks also include regional transportation infrastructure development not occurring as now planned, with important Bradfield linkages not materializing.

### Distribution of Benefits and Costs

- If Canadian benefits are assumed to include essentially all the mining benefits, half the personal/recreational travel benefits, and two-thirds of the timber-related benefits, as measured in this study, the net present value of the Canadian portion of project benefits would total \$170 million, based on a 3 percent discount rate. The present value of construction and maintenance costs for the Canadian portion of the road totals \$46 million (also based on a 3 percent discount rate). This suggests a net present value of \$124 million and a benefit/cost ratio of 3.7.
- At a 7 percent discount rate, the Canadian portion of the project has a net present value of \$53 million and a benefit/cost ratio of 2.3. US and Canadian project economic viability under different discount rate assumptions are summarized in the following table.

**US and Canadian Net Present Value and Benefit/Cost Analysis  
Bradfield/Iskut Transportation Corridor**

Discount Rate	Present Value of Benefits (millions)	Present Value of Costs (millions)	Net Present Value (millions)	Benefit/Cost Ratio
<b>3 percent</b>	<b>\$300</b>	<b>\$192</b>	<b>\$108</b>	<b>1.6</b>
US	130	146	-16	0.9
Canada	170	46	124	3.7
<b>5 percent</b>	<b>\$215</b>	<b>\$196</b>	<b>\$19</b>	<b>1.1</b>
US	90	152	-62	0.6
Canada	125	45	80	2.8
<b>7 percent</b>	<b>\$160</b>	<b>\$187</b>	<b>\$-27</b>	<b>0.9</b>
US	65	146	-81	0.4
Canada	95	42	53	2.3

- This analysis suggests that the Bradfield/Iskut road project has the potential to be a stronger investment from the Canadian perspective. This conclusion is largely contingent upon the nature and magnitude of mining activity that is spurred by corridor development.
- Over the very long-term (beyond the 30 years considered in this study), Alaska benefits relative to costs could be expected to increase, as regional population and traffic growth places greater and greater demands on the region's surface transportation infrastructure, and more traffic moves through the Bradfield/Iskut corridor.

## Sensitivity Analysis

- In addition to being sensitive to the discount rate, the economic viability of the Bradfield/Iskut road depends on terminal location. The Duck Point option (the highest cost option) has a benefit/cost ratio of 1.2 at a 3 percent discount rate, but is below 1.0 at other discount rates (0.8 at 5 percent and 0.7 at 7 percent). The benefit/cost ratio for the Kapho Mountain option is 1.5 at a 3 percent discount rates, 1.0 at 5 percent, and 0.8 at 7 percent.
- The economic viability of the project is also highly sensitive to assumptions about mining-related benefits (where potential industrial benefits are the most speculative). If there are no significant benefits associated with hauling ore concentrates to Bradfield, the net present value of the overall project is negative under all but the 3 percent discount rate scenario (which produces a benefit cost ratio of 1.2).
- Higher or lower than expected construction costs affect project viability. If construction costs are 25 percent lower than expected the net present value of the project would be \$145 million, with a benefit cost ratio of 1.9, at a 3 percent discount rate.
- Cost/benefit analysis based on construction costs lower than those presented in this study is warranted. Most (if not all) of the benefits associated with development of the Bradfield/Iskut corridor could materialize with a lower standard road. Construction costs for a 6 meter, gravel surface road on the Canadian side were about one-third less than a 7.2 meter paved road. In addition, road construction cost estimates include 25 percent or higher contingencies, indicating that the estimates may be conservative.

### Net Present Value and Benefit/Cost Analysis With 25% Lower Construction Costs Bradfield/Iskut Transportation Corridor\*

Discount Rate	Present Value of Benefits (millions)	Present Value of Costs (millions)	Net Present Value (millions)	Benefit/Cost Ratio
3 percent	\$300	\$155	\$145	1.9
5 percent	\$215	\$156	\$59	1.4
7 percent	\$160	\$148	\$12	1.1

\*Based on road construction costs that are 25 percent below what has been estimated for a two-lane paved road. Includes Alaska and BC road segments.

- It should also be noted that US/Canadian dollar exchange rates have some bearing on the presentation of overall project costs and benefits. During the course of this study, the US dollar was weakening relative to the Canadian dollar. As a result some Canadian costs and benefits may be understated in terms of current US dollars.

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## **Purpose of the Study**

A road east from Wrangell to the Cassiar region of British Columbia has for many years been viewed as an option for improving surface access to Southeast Alaska. The purpose of this study is to measure the benefits and costs associated with development of a Bradfield/Iskut road between the mouth of Bradfield Canal in Southeast Alaska and Highway 37 (the Cassiar Highway) in the Iskut Valley in British Columbia.

Benefits examined in this study include those associated with mining, timber, tourism/recreation, the seafood industry, freight movement, and hydroelectric-related development. The Iskut and Highway 37 areas are richly mineralized, with a number of mining projects that could benefit from improved access. A road link to tidewater in Southeast Alaska could enhance development of timber resources in the Iskut River area. A new road link into Southeast could affect the cost of transporting freight in and out of the region. Reliable and timely fresh seafood transportation has long been sought by Southeast communities. Tourism and recreation benefits might also result from a Cassiar road link. This study measures these and other potential benefits.

An important objective of this study is to calculate the cost of developing and maintaining the proposed 86-mile (138 km) Bradfield/Iskut road. The road would traverse challenging terrain, requiring numerous bridge crossings and a lengthy tunnel.

From a socioeconomic perspective, a Bradfield/Iskut road could stimulate the depressed Wrangell economy and result in other economic benefits in Southeast Alaska. However, there is a concern that a road link between the Cassiar and Southeast Alaska would funnel benefits from mining, timber, and tourism activity in British Columbia away from Canadian communities such as Stewart and Prince Rupert. An additional purpose of this study is to determine how the benefits of road construction would be distributed among communities on both sides of the Alaska/BC border.

## **Methodology**

This study measures potential economic benefits associated with all forms of usage of the proposed Bradfield/Iskut road. Industrial benefits related to mining, timber harvest, the movement of fish, and the movement of general freight is considered. Industrial benefits were measured through interviews with resource developers in BC and Alaska, as well as through analysis of published data. Household and recreational/leisure travel on the proposed highway were assessed using data on ferry, highway and airline travel to and through the region. Community impacts were assessed based on anticipated movement of people, goods and resources stemming from development of the Bradfield/Iskut corridor.

Most transportation improvement projects are judged in terms of how much traffic will utilize the new road, bridge, ferry or other transportation service. Traffic is usually measured in terms of diverted traffic (traffic now accommodated by existing ferry or airline service) and induced traffic (new travel that would not have happened in the absence of the transportation improvement). Estimating diverted traffic is an exercise in comparing travel costs associated with transportation options. Predicting induced traffic is much more subjective and is often supported by survey research (which is outside the scope of this project). In any case, with fundamentally new infrastructure, such as the Bradfield/Iskut road, broad assessments must drive the traffic analysis. Is the improvement so pronounced that most or all freight traffic will divert? Is the improvement a competitive improvement that will divert a large share of market? Or does the improvement represent an opportunity only for those with more specialized shipping or transportation needs? These and other similar questions are addressed.

### **Net Present Value (NPV) and Benefit/Cost Ratio**

Net present value and benefit/cost measures are used to assess the economic viability of the proposed road construction project. The net present value (NPV) is the current value of a future stream of costs and benefits. If the NPV is greater than zero, the project is economically justified. Similarly, if the benefit/cost ratio is greater than one, the project is economically feasible. A more detailed discussion of these measures of project viability follows.

Net present value (NPV) is considered the standard measure of economic desirability for transportation-related infrastructure investment, according to the American Association of State Highway and Transportation Officials. AASHTO describes the NPV as:

An economic concept that represents the translation of specified amounts of costs and benefits occurring in different time periods into a single amount at a single instant (usually the present). The term net present value refers to the net cumulative present value of a series of costs and benefits stretching over time. It is derived by applying to each cost or benefit in the series an appropriate discount factor, which converts each cost or benefit to a present value. Two related considerations underlie the need for computing present values: (1) the fact that money has intrinsic capacity to earn interest over time—known as the time value of money... and (2) the need in an economic study for comparing or summing incremental outlays or savings of money in different time periods.

Benefit/cost analysis compares the present value of project costs with the present value of project benefits. If the ratio of the present value of benefits compared to cost is greater than one, the project is economically justified. If the ratio is less than one the project is not economically justified.

To calculate the benefit/cost ratio, the future stream of project costs are discounted and summed to a single present value, the future stream of project benefits are also discounted and summed to a single present value, then the total benefit is divided by the total cost.

Before the NPV and/or benefit/cost ratios can be calculated, several parameters must be defined, including the project schedule, the period of analysis, and the discount rate.

## Construction Schedule

For purposes of this study, it is assumed that construction of the Bradfield/Iskut road would begin after a three-year NEPA process and would require six years for construction. It is assumed the road would be in service for industrial traffic in 2011 and the corridor fully developed (including Bradfield ferry service) by 2014. It is further assumed that the Ketchikan Access project (the road linking Ketchikan and Bradfield) would be in place by 2016.

## Period of Analysis and Residual Values

The period of analysis used in this study is 30 years. While AASHTO suggests that traffic projects be analyzed over periods of 15 to 25 years, and other texts of transportation economics recommend 20 years, a longer period of analysis is appropriate here because of the relatively long period of time required for pre-construction and construction activity.

When the economic life of the asset is longer than the period of analysis, the residual value of the asset must be considered. The residual value is essentially the remaining value of the asset at the end of period analysis.

In NPV and benefit/cost ratio analyses, the residual value of the roadway and related structures at the end of the period of analysis (30 years) are calculated. The useful lives of the roadway components are presented in the following table.

**Table I.1**  
**Highway Residual Values**

	Useful Life Range (Years)	Assumed Useful Life	% of Total Initial Value after 30 years
Right of Way	75 to 100	100	70%
Earth Work	60 to 100	80	63.5%
Structures	50 to 75	60	50%
Other	variable	20	-

Using residual values allows for the economic evaluation of transportation improvements without attempting to predict traffic 40 or 50 years in the future.

## Discount Rate

Discount rates used for purposes of benefit/cost and net present value analyses range from 3 percent to 7 percent. Seven percent is the rate recommended in OMB Circular No. A-94 for evaluating federal programs whose benefits and costs are distributed over time.<sup>1</sup> Considering other discount rates is important, however, because of the subjective nature of discounting future benefits and costs.

## Sensitivity Analysis

Benefit/cost and NPV are good indicators of economic viability, based on a specific set of predicted costs and benefits. However, it is important to measure the change in benefit/cost ratios or NPV that results from a change in cost (for example, higher

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<sup>1</sup> "OMB Circular No. A-94 Revised", U.S. Office of Management and Budget, October 29, 1992.

or lower than expected construction costs) or a change in benefit (for example, more industrial traffic than expected). This “sensitivity” analysis is critical in cases where there is a significant degree of uncertainty about potential costs and benefits, such as this study.

### Conversion Factors

All tonnage and distance measures are presented in both the standard and metric systems. Unless explicitly stated otherwise, all dollar values are in US dollars. The following table presents conversion factors and related information.

**Table I.2**  
**Conversion Factors**

1 short ton (2,000 lbs)	=	0.9071 metric tonnes
1 metric tonne	=	1.102 short tons
1 mile	=	1.6093 kilometers
1 kilometer	=	0.621 miles
\$1.00 US	=	\$1.43 Canadian
\$1.00 Canadian	=	\$0.70 US

### Highway Travel Distances

The following table provides travel distances between key points related to travel on the Bradfield/Iskut road. Bob Quinn is located at the juncture of Highway 37 and the proposed Bradfield Road (a portion of the road, from Bob Quinn to Volcano Creek, is in place as a private resource road). Kitwanga is at the juncture of Highway 37 and Highway 16 and represents a point at which all highway traffic into or out Southeast Alaska must pass (whether through Prince Rupert or Bradfield).

**Table I.3**  
**Highway Mileage Between Key Study Area Locations**

	Miles	Kilometers
Bradfield Terminal to Border	28	45
Bradfield Terminal to Bob Quinn	86	138
Bradfield Terminal to Kitwanga	271	436
Bradfield Terminal to Seattle	1,133	1,824
Bob Quinn to Stewart	130	209
Bob Quinn to Kitwanga	185	298
Ketchikan to Bradfield Terminal	77	124
Ketchikan to Seattle via Bradfield	1,210	1,948
Kitwanga to Prince Rupert	150	242
Kitwanga to Seattle	863	1,389
Prince Rupert to Seattle	1,013	1,630
Wrangell to Fools Inlet Terminal	35	56

## Previous Bradfield-Related Studies

The Bradfield Canal region has been the subject of numerous transportation studies over the years. The project was originally proposed as providing a land-based link between Southeast Alaska and the continental road system to support mining activity in British Columbia. Proponents of the road have also pointed to the economic benefits of enabling faster movement of seafood and timber products to market, and the potential benefits of a link with the Canadian power grid. The Bradfield route began to receive serious consideration in the mid to late 1980s as a result of mining activity in the Iskut River area. The area saw a surge of mining activity, much of it supported through Wrangell via aircraft or watercraft. Recognizing the potential economic benefits for Alaska from a road link to the Iskut area, in 1990 the Alaska Legislature passed House Bill 311, authorizing the issuance of revenue bonds for up to \$22.3 million for construction of a Bradfield River resource road.<sup>2</sup>

Some previous studies examining the feasibility of constructing a road to the Bradfield Canal include:

- *Bradfield Industrial Road Feasibility Study* prepared by S.C. Jacoby and Associates for the Alaska Department of Transportation and Public Facilities, 1989. The study concluded a mine access road could be built from the Bradfield Canal to the Canadian border for \$23 million including the construction of a tunnel. The DOTPF concluded that costs were underestimated by \$40 million. In 1997, the DOTPF estimated a one-lane gravel road and tunnel would cost \$65 million, but concluded the BC government would not support the road on the Canadian side because a port on Bradfield Canal would compete with the existing ports of Stewart and Prince Rupert.
- *A Benefit Cost Analysis of Transportation Alternatives for the Iskut Valley* prepared by Clayton Resources Ltd. for the British Columbia and Canadian governments, 1989. The study forecast that four proposed BC gold mines might benefit from the road. For two of the mines, a \$25 million savings was estimated for a road versus air transport. For the other two mines, a \$9 million savings was projected from the avoided cost of building a privately financed road and \$9 million savings for reduced exploration costs. The Johnny Mountain and Snip gold mines were short lived and used hovercraft and air transport services from Wrangell. The Eskay Creek mine built part of the Iskut road. The Sulphurets property was never developed.
- *A Benefit/Cost Study for the Proposed Ketchikan/Bradfield/Cassiar Transportation Corridor* prepared by the McDowell Group, Inc. with Peratrovich, Nottingham, & Drage, Inc., Avalon Development Corporation, and BST Associates for the Alaska Department of Commerce and Economic Development, 1994. The study found a benefit cost ratio of 1.24 for a Bradfield pioneer road, and 0.76 for the two-lane highway.
- The US Department of Agriculture and Forest Service in 1998 estimated the cost of a public highway from Ketchikan to the border at \$340 million. The

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<sup>2</sup> "Bradfield Road Status Report", Senator Robin Taylor, July 1992.

Forest Service also estimated the cost of the Canadian portion at \$87 million. In March 2003, The USDA Forest Service reviewed a wide range of Southeast Alaska proposed public road and ferry projects. Their estimate for 14 miles of new road and 14 miles of upgrading an existing forest service road from Bradfield to the border was \$140 million.

- The *Southeast Alaska Transportation Plan* includes the Bradfield road and various related developments. The plan places traffic on the Bradfield at 100 AADT in 2011 increasing to 130 AADT by 2021, with summer ADT at between 270 and 320 for the same period. The cost of the project is estimated at \$257 million for the 28 miles to the border, \$58 million for the Fools Inlet Road and ferry terminal, and \$16 million for the Fools Inlet ferry (to Bradfield). The study also estimated the cost of the road from Ketchikan to Bradfield at \$258 million.

These previous studies provide important guidance in the development of the scope and workplan for this economic assessment. This more comprehensive and updated analysis is essential because of changing economic and political conditions on both sides of the Alaska/BC border.

## Study Team

The McDowell Group, Inc., a research and consulting firm with offices in Juneau and Anchorage, served as the lead contractor on this study. The McDowell Group has studied the economics of most major transportation developments in Southeast Alaska over the past ten years. McElhanney Consulting Services, a Canadian engineering and transportation planning company with offices in B.C. and Alberta, led the analysis of road construction costs on the B.C. side of the border. G. E. Bridges and Associates, Inc., a Victoria-based economics consulting and research firm, assisted in the analysis of industry and community impacts in B.C. Peratrovich, Nottingham and Drage (PN&D), Inc., with expertise in marine terminal design as well as highway engineering, assessed the cost of marine terminal construction and served in a peer review capacity on US road construction cost estimates, which were developed by the Western Federal Lands Highway Division of the Federal Highway Administration (WFLHD).

### The Bradfield/Iskut Corridor

The Bradfield/Iskut Transportation corridor would include construction of an 86-mile (138 km) road from the head of Bradfield Canal, up the Bradfield River Valley 28 miles (45 km) to the Alaska/BC border, down the Craig River valley in British Columbia, then along the Iskut River to Highway 37 near Bob Quinn. Highway 37 was constructed in the 1960s to provide tidewater access at Stewart for the Cassiar asbestos mines, which closed in 1992.

On the Canadian side of the border, 19 miles (31 km) of new road would be built from Volcano Creek past the former Snip and Johnny Mountain mines and another 16 miles (26 km) up the Craig River to the Alaskan border for a total of 35 miles (56 km) of new road. The Canadian portion of the road would utilize 23 miles (37 km) of the existing Eskay Creek mining road and would be 58 miles (93 km) in total length.

To the south, Highway 37 interconnects with Highway 16 at Kitwanga, which is the closest rail access point. Highway 16 is a major east-west BC highway connecting Prince Rupert with Prince George.

**Figure II.1**  
**Head of Bradfield Canal, Looking Up-River<sup>3</sup>**



The road is currently envisioned as 24-foot, two-lane paved highway. This meets US federal highway standards for “rural collector” highway, defined as a highway with traffic volumes of less than 400 AADT. The corridor includes a 7,000-foot tunnel near the border, linking the upper reaches of the North Fork of the Bradfield River and the Craig River.

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<sup>3</sup> Air photos provided by Western Federal Lands. Other photos, unless otherwise noted, provided by GE Bridges & Assoc.



The corridor concept includes a marine terminal at the head of Bradfield Canal which would include a “no-frills terminal capable of serving conventional hull AMHS-type vessels and small cruise ships.”<sup>4</sup> The concept does not include public funding for construction of a deepwater port capable of handling freighters or other deep-draft vessels.

Though this study does not consider the costs and benefits of ferry service to the proposed Bradfield terminal, the corridor concept includes ferry service, as well as connecting highway links. In fact, the Bradfield/Iskut transportation corridor concept is most meaningful when considered in the context of long-term regional transportation planning (see *Southeast Alaska Transportation Plan* discussion, below).

**Figure II.2**  
**Craig River North to Iskut River<sup>5</sup>**



**Figure II.3**  
**Iskut River West from Volcano Creek<sup>6</sup>**



## Corridor Land Use Issues

The 1997 Tongass Land Management Plan designates the forested area on the U.S. side of the proposed Bradfield/Iskut road as Timber Production, land use

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<sup>4</sup> “Bradfield/Iskut Transportation Corridor Economic Assessment Request for Proposals,” Alaska Department of Community and Economic Development, November 2003.

<sup>5</sup> Bell II Lodge Fishing Adventures [http://www.steelhead-fishing.net/gallery\\_2002.htm](http://www.steelhead-fishing.net/gallery_2002.htm)

<sup>6</sup> University of North Dakota [http://volcano.und.nodak.edu/vwdocs/volc\\_images/north\\_america/canada/Final-Iskut.html](http://volcano.und.nodak.edu/vwdocs/volc_images/north_america/canada/Final-Iskut.html)



designation TM. The goal of this designation is to maintain and promote industrial wood production from suitable timber lands. Areas in the Timber Production land use designation (LUD) are characterized as suitable timber lands managed for the production of sawtimber and other wood products on an even-flow, long-term sustained yield basis.

In BC, the Land and Resource Planning Process (LRMP) is a public land use planning process, which makes recommendations to government with respect to land uses and protected areas. The Cassiar Iskut-Stikine Land and Resource Management Plan (LRMP) provides policy direction for the use of Crown land and resources over a 5.2 million hectare of the southern portion of the Cassiar Timber Supply Area, including the Canadian portions of the Stikine and Unuk River drainages.

Within the Iskut River area, the Cassiar Iskut-Stikine Land and Resource Management Plan, approved by government in October 2000, identified 19,000 acres of the Craig River headwaters as park.<sup>7</sup> The LRMP plan also recommends protection of a corridor along the Iskut River from Highway 37 at Bob Quinn to the Craig River, which includes the Lower Iskut and Stikine Rivers.<sup>8</sup> The LRMP plan respects the existing mineral tenures within the Craig River park until such time that the tenures lapse.

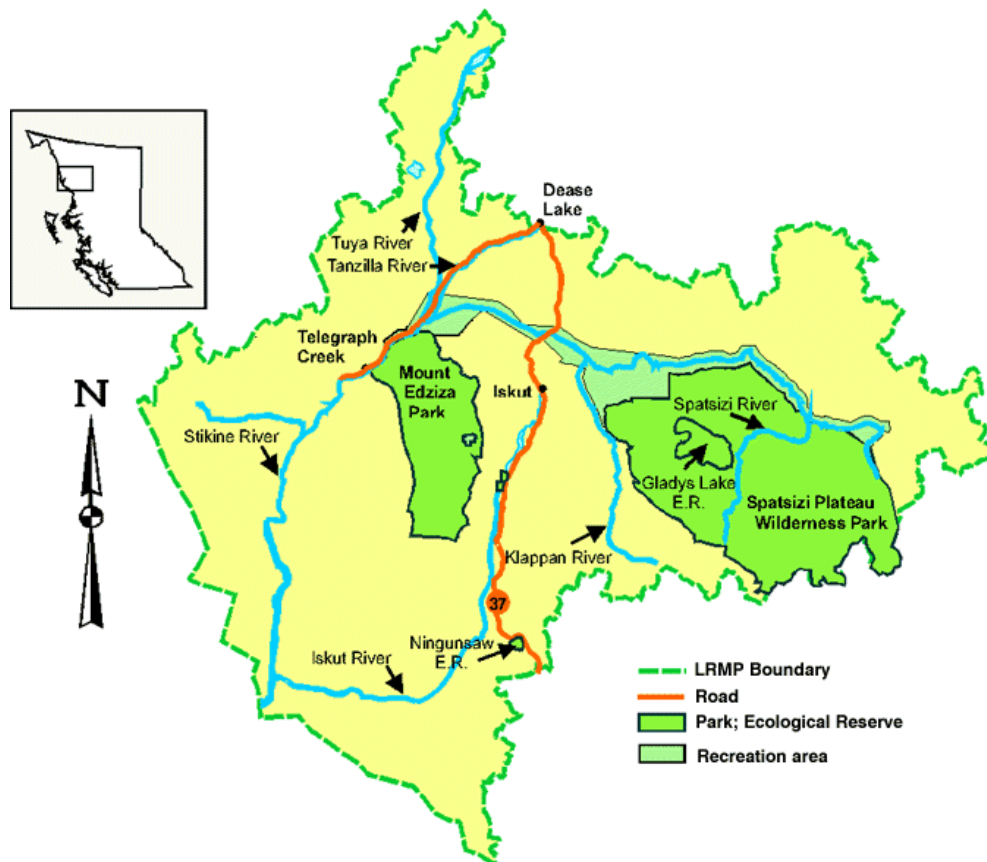
The areas relevant to the Bradfield-Iskut road alignment includes the Middle and Lower Iskut River Zones, and the Craig River Headwaters.

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<sup>7</sup> BC Ministry of Sustainable Resource Management [http://srmwww.gov.bc.ca/ske/lrmp/cassiar/final/2\\_5.htm#2.5.2](http://srmwww.gov.bc.ca/ske/lrmp/cassiar/final/2_5.htm#2.5.2)

<sup>8</sup> <http://srmwww.gov.bc.ca/ske/lrmp/cassiar/newsletter/nl1099.htm>

**Figure II-4**  
**Cassiar Stikine-Iskut land and Resource Management Planning Area**



### **Middle Iskut Zone**

The Middle Iskut zone (176,000 hectares) follows the Iskut River to Forrest Kerr Canyon and straddles the Highway 37 corridor south of Kinaskan Provincial Park. This zone includes a significant portion of the timber harvesting land base for the LRMP area and is the main area where commercial timber harvesting has occurred to date. Riparian areas along this section of the river are part of a unique transitional ecosystem linking Interior Cedar Hemlock ecosystems with boreal forest to the north.

Much of this zone also includes Highway 37, which supports significant tourism traffic. Because of the proximity of the highway and other roads, several sections of the river are accessible, providing a range of recreation opportunities, including kayaking, rafting, hiking along canyons, camping at Devil Lake and visiting the Iskut Hot Springs to the north.

The management objective is to maintain the riparian habitat along the Iskut River and to maintain the recreation values along the river and highway corridor, while continuing to allow commercial timber harvesting and mineral exploration and

development. There is a minimum 100 meter reserve zone extending from each edge of the Iskut floodplain, which excludes timber harvesting.

### **Access Constraints**

- For new roads, public access will be restricted west of the Iskut River using river crossings as access control points to minimize impacts on grizzly habitat.
- In the interest of maintaining biodiversity, the location of main haul forestry roads will be as far as possible from the Iskut River.

### **Lower Iskut Zone**

The Lower Iskut zone (12,000 hectares) connects the Middle Iskut zone and down to the confluence of the Craig River of the Iskut where the Lower Stikine-Iskut Grizzly Salmon Management zone starts. The intent of this zone is to conserve the fisheries and habitat values of the Lower Iskut River and to provide management continuity between the Middle Iskut and Lower Stikine-Iskut zones. Commercial timber harvesting is not allowed on the floodplain of the Iskut River.

### **Access Constraints**

- Main stem road development is allowed only on one side of a valley at any one location.
- Wherever possible, combine all infrastructure development (including power lines) with existing or planned roads.

### **Craig River Headwaters**

From the Iskut River, the Bradfield-Iskut would head up the Craig River drainage into the Craig River headwater, an area of 7,500 hectares, which since 2000 has been designated as a park. The Craig River Headwaters Park was established to protect low elevation coastal western hemlock forest and associated ecosystems, which includes:

- Fisheries values, including salmon spawning and rearing habitat
- Grizzly habitat
- Key areas of grizzly/salmon interaction
- High recreational values (remote access)

The existing mineral tenures within the protected area boundary will be excluded from the protected area until such time as the tenures lapse.

### **Access Constraints**

In the event that a road request is made and where a reasonable review determines that no practicable alternative exists outside of the protected area, then Government authorities will make a decision regarding the access request. The decision will be

made in consideration of the integrity of the protected area and the need for road access for mineral activities, in accordance with applicable approval processes.

The Craig River area is noted for its fisheries values, its grizzly bear habitat, and key areas of grizzly/salmon interaction and related recreational values. The Craig River is famous for its salmon fishing, and guides located at Bell II (Highway 37) bring fishermen in by helicopter.

## **The Southeast Alaska Transportation Plan**

Long-term development of Southeast Alaska's regional transportation infrastructure has important implications for the Bradfield/Iskut corridor. New road links and changes in ferry service will significantly affect corridor traffic. The Southeast Alaska Transportation Plan (SATP), updated in 2004, proposes upgrades to existing roads, the construction of new roads, and restructuring portions of the regional ferry system to reduce the state subsidy of the fleet. The three primary themes of the SATP update are: the introduction of roads to complement the regional ferry system at every opportunity, identifying and protecting road and utility corridors for future development to respond to both identified and unidentified future needs, and deploying fast vehicle ferries (FVFs) on point-to-point routes between 70 and 148 nautical miles in length one-way where passenger volumes are sufficient (75 percent capacity utilization).

The SATP update recommends restructuring the Alaska Marine Highway System to reduce reliance on mainliner ferry service. The new proposal would reduce the mainliner fleet from five to four mainline ferries and alter the existing routes. Only two mainline ferries would serve Southeast by 2010: both would serve ports from Bellingham through Southeast Alaska. The two additional mainline ferries would serve cross-Gulf of Alaska traffic and from Kodiak out the Aleutian Chain. A fleet of shuttle ferries operating in Southeast Alaska and Prince William Sound would support the mainline fleet.

The draft update supports road construction between Juneau and Skagway, a new mid-region road connection via the Bradfield Canal, a road across Baranof Island to reduce the length of the Sitka ferry links, and road shuttle ferry connections to the proposed Bradfield Road from both Ketchikan and Wrangell. Several projects planned for the area would affect the Bradfield Road.

### **Wrangell Access**

The SATP includes extending Zimovia Highway to Fools Inlet, a distance of 22 miles (35 km), where a ferry terminal would be constructed. The cost of the highway extension and ferry terminal in Fools Inlet was estimated at \$58 million in the SATP. This project would serve two purposes. In combination with a North Tongass Terminal, the Fools Inlet terminal would make possible two FVF round-trips per day between Wrangell and Ketchikan. More important, the Fools Inlet ferry terminal would serve a shuttle ferry dedicated to Bradfield Canal. The SATP Draft Update estimated the cost of a dedicated Bradfield shuttle ferry at between \$12 million and \$16 million.

## **“East Highway” Ketchikan to Bradfield Canal**

The “East Highway” project (Ketchikan Access) involves the construction of a road to the north end of Revillagigedo Island where terminals would be constructed and a Behm Canal shuttle ferry deployed. A Behm Canal Shuttle Ferry would connect with a road across the upper Cleveland Peninsula following the Eagle River Valley to a connection with the Bradfield Road. The SATP includes a ferry terminal just west of the Eagle River in the Bradfield Canal where a shuttle ferry would provide a connection between the Eagle River Ferry Terminal and Fools Inlet. This project is independent of the Bradfield Canal Road but clearly each would see higher traffic if the other is built. The SATP places the cost of the East Highway at about \$265 million. This project is planned for completion between 2010 and 2025.

## **Southern Gateway Shuttle**

The Southern Gateway Shuttle is planned to be in service between Ketchikan and Prince Rupert, British Columbia by 2007 or 2008. This ferry would provide non-stop vehicle and passenger service between these communities. With initiation of this shuttle service, mainline service to Prince Rupert would end. Shuttle ferry service would be provided by a 25-knot ship with a capacity of 50-65 vehicles including up to 15 loaded vans. The vessel would be dedicated to the Ketchikan/Prince Rupert run. Service is anticipated to be daily during the 22-week summer season and four days a week during the winter, with a six-week lay-up.

If the new ferry is not available for service by 2007, the SATP recommends that the M/V Matanuska be deployed on the Ketchikan/Prince Rupert run.

These projects all have important implications for the Bradfield/Iskut road. The Fools Inlet ferry terminal is essential in providing efficient ferry service to Bradfield. The Ketchikan Access project, coupled with the Bradfield road, would provide improved access to the continental highway system for Ketchikan’s business sector and 14,000 residents. The Southern Gateway shuttle is important in that it improves access to the continental road system. This service would be complementary with the Bradfield road in some markets, potentially competitive in others.

## **Study Assumptions about Regional Transportation Infrastructure Development**

The SATP assumes that Bradfield/Iskut road and Ketchikan Access projects will be completed sometime during the 2010 to 2025 period. For purposes of this study it is assumed that the Bradfield is completed by 2011 and Ketchikan Access by 2016. The Wrangell Access project is assumed to be developed concurrent with the Bradfield road.

This study addresses the benefits and costs of the Bradfield independent of Ketchikan Access-related costs. Similarly, the commercial and industrial benefits of a highway link between Bradfield and Ketchikan are excluded (such as timber

harvests along the new highway, movement of fresh fish from Ketchikan, etc.).<sup>9</sup> However, additional Bradfield road vehicle traffic that would be generated as a result of Ketchikan access is included in the Bradfield/Iskut corridor traffic forecasts.

## Bradfield-Related Access Improvements

With development of the Bradfield/Iskut corridor and implementation of other aspects of the SATP, residents of Southeast Alaska will have several new options for accessing the continental highway system.

Currently, the nearest highway connection for Wrangell residents is a 12-hour ferry ride to Prince Rupert. Prince Rupert service is available four days per week during the summer and twice a week during the winter. With the Bradfield road, access would be possible with a 35-mile (56 km) drive to the Fools Inlet ferry terminal and at least daily ferry service to the Bradfield road, a ferry trip of approximately one hour. Southeast residents to the north of Wrangell would experience the same travel time savings to the continental highway system (plus additional travel time savings associated with other aspects of the SATP).

With full implementation of the SATP, Ketchikan residents will choose between a drive to Bradfield (with the Behm Canal shuttle ferry link) or an FVF trip to Prince Rupert. Prior to construction of the Ketchikan to Bradfield Canal highway, access to Bradfield from Ketchikan could be provided by FVF service to Fools Inlet (though this particular service is not envisioned in the SATP).

To illustrate the potential impact on travel between the communities of Wrangell and Ketchikan and the continental highway system, travel times and costs are estimated for a trip to Kitwanga, BC. Kitwanga is a highway crossroads where Highway 37 (Cassiar Highway) and Highway 16 intersect. Continental highway travelers destined for (or traveling from) Ketchikan, Wrangell or other central and southern Southeast communities would pass through Kitwanga, whether passing through Prince Rupert or using the proposed Bradfield/Iskut road.

**Wrangell:** The drive from Kitwanga to Prince Rupert is approximately 150 miles (241 km). The ferry trip from Prince Rupert to Ketchikan is about six hours, and about 12 hours to Wrangell. The cost of the trip between Kitwanga and Wrangell via Prince Rupert, for a party of two adults and one standard size vehicle, would be \$345, including ferry costs (\$275, based on the 2004 AMHS fare structure) and a vehicle cost of \$70 (for the drive between Prince Rupert and Kitwanga).<sup>10</sup>

The trip between Kitwanga and Wrangell via Bradfield would include three legs: the drive to Bradfield Canal, the ferry trip to Fools Inlet, and a drive from Fools Inlet to Wrangell. The drive between Kitwanga to the head of Bradfield Canal is approximately 271 miles (436 km). Vehicle costs for the drive would be approximately \$127. Assuming the cost of the ferry trip between Bradfield and Fools Inlet would be about the same as ferry service between Metlakatla and Ketchikan,

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<sup>9</sup> If these benefits were to be included, the costs of Ketchikan Access road construction and maintenance must also be included, an analysis beyond the scope of this study.

<sup>10</sup> One-way adult passenger fare between Prince Rupert and Wrangell is US\$72. Vehicle fare (up to 15 feet) is US\$133 one-way. Mileage cost based on a mileage rate of US\$0.47 cents per mile, including operating and ownership costs.

total costs for this leg of the trip would be about \$70.<sup>11</sup> Finally, the drive from Fools Inlet to Wrangell, a distance of approximately 35 miles (56 km), would have a vehicle cost of about \$16. Total cost for the trip would be \$213, \$132 less (38 percent) than travel through Prince Rupert. Adding a third or fourth traveler to the party further improves the economics of the Bradfield route.

**Ketchikan:** The economics of travel between Kitwanga and Ketchikan are somewhat different. Via Prince Rupert the cost includes the \$70 vehicle expense and ferry costs of \$188, for a total of \$258. Travel between Kitwanga and Ketchikan via Bradfield prior to construction of the road between Bradfield and Ketchikan would include a Ketchikan/Fools Inlet ferry link, a Fools Inlet/Bradfield ferry link, and the 271-mile (436 km) drive between Bradfield and Kitwanga. The cost of this trip (again for a party of two adults in a standard passenger vehicle) would be about \$126 for the Ketchikan/Fools Inlet ferry link, \$70 for the Fools Inlet/Bradfield link, and \$127 in vehicle costs for the Bradfield/Kitwanga highway link, for a total of approximately \$323, \$65 more than travel via Prince Rupert.<sup>12</sup>

Once the Ketchikan/Bradfield highway is constructed, the economics of Ketchikan resident travel via Bradfield will improve. Travel between Ketchikan and Kitwanga would include the 77-mile (124 km) Ketchikan/Behm Canal drive, the shuttle ferry across Behm Canal, the 40-mile (64 km) drive between Behm Canal and the head of Bradfield Canal and finally the 271-mile (436 km) Bradfield/Kitwanga highway link. For purposes of this discussion, it is assumed that Behm Canal ferry costs would be about half of the current Ketchikan/Metlakatla cost, or about \$35 for a party of two with a 15-foot passenger vehicle. Vehicle costs would total \$163 for the 348 miles (560 km) in highway links. Total costs for this route would be \$199, \$59 lower than via Prince Rupert.

**Table II.1**  
**Access (Travel Cost) to the Continental Highway System for Southern**  
**Southeast Alaska Communities**

Origin	Current Travel Cost to Kitwanga (via Prince Rupert)	Travel Cost to Kitwanga via FVF to Fools Inlet and Shuttle to Bradfield	Travel Cost to Kitwanga via Bradfield and Ketchikan Access Highway
Wrangell	\$345	\$213	\$213
Ketchikan	\$258	\$323	\$199

This analysis indicates that Wrangell residents would benefit immediately with construction of the Bradfield road. Ketchikan residents seeking southbound access to the continental highway system would benefit after construction of the Ketchikan/Bradfield highway.

<sup>11</sup> Published fares for the M/V Lituya are \$21 one-way for adult passengers and \$28 one way for vehicles 10 to 15 feet.

<sup>12</sup> Ketchikan/Fools Inlet ferry costs are based on published AMHS Ketchikan/Wrangell fares. Fools Inlet/Bradfield ferry costs are assumed to be equal to Ketchikan/Metlakatla ferry costs.



## Travel Times

The travel times from Wrangell and Ketchikan, under various access scenarios to various destinations, are indicated in the following table. Prior to development of road access between Ketchikan and Bradfield, it is assumed that Ketchikan would be linked to Bradfield via a five-hour ferry ride to Fools Inlet.

**Table II-2**  
**Travel Time (in Hours) to Key Destinations**  
**from Wrangell and Ketchikan**

	Current (AMHS)	Bradfield w/o Ketchikan Access	Bradfield w/ Ketchikan Access
<b>Wrangell to:</b>			
Kitwanga	16	8	8
Prince Rupert	13	11	11
Seattle	49	22	22
<b>Ketchikan to:</b>			
Kitwanga	9	10	7
Prince Rupert	6	13	10
Seattle	43	28	23

Taking Seattle as the point of reference, the ferry route between Wrangell and Seattle would take 49 hours. Using the Fools Inlet ferry and Bradfield/Iskut road, the travel time would be 22 hours. However, since the majority of this is driving time, requiring layover during the evening, overall elapse time would likely be longer (from eight to ten hours longer depending on the length of the layover).

Travel times between Ketchikan and Seattle are also slightly improved, but not as significantly. With construction of the Bradfield road, but prior to construction of Ketchikan Access, travel time between Ketchikan and Seattle would be 28 hours plus lay-over, compared to the 43 hours total elapsed time on the ferry. Once the road between Ketchikan and Bradfield is constructed, travel time between Ketchikan and Seattle would be reduced to 23 hours, plus layover time.

The movement of freight could be similarly affected by travel cost savings related to improved access to the continental highway system. Movement of general cargo, and particularly time-sensitive goods such as groceries and fresh fish, will be affected. These effects are described in detail in following chapters.

This discussion has focused on the potential benefits of the Bradfield Road project (and the SATP) on movement of vehicles and passengers into and out of Southeast Alaska. These and related benefits are described in more detail in a following chapter. From the perspective of British Columbia, the most important benefits of the Bradfield/Iskut corridor may stem from effects on resource development in the Iskut Valley and along the Highway 37 corridor. Improved access to mineral and timber resources, for example, may have the potential to generate substantial savings to resource developers. The next chapters address these potential benefits.



### **III. MINING INDUSTRY BENEFITS**

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The BC Ministry of Energy and Mines considers the Iskut-Stikine area one of the richest mineralized areas in the province. The mining industry may have the most to gain from improved access to tidewater. This section reviews the numerous mine prospects in the Iskut area, as well as the Highway 37 corridor in general, and how Bradfield-related access might affect exploration, mine development and mine operations in the area.

#### **Iskut Valley Properties**

##### **Barrick Gold (Snip Mine)**

Now owned by Barrick Gold, the Snip Mine is an inactive underground mine located 19 miles west of Volcano Creek near Bronson Creek, about 1.3 miles (2.1 km) south of the Iskut River.<sup>13</sup> The Snip Mine was a high-grade gold mine and mill that operated from 1991 to 1999. The mill processed about 400 tons per day using simple gravity flotation to process its high-grade gold ore. About 1.2 million tons of ore were mined to produce 1.13 million ounces of gold, 0.42 million ounces of silver, and 550,000 pounds of copper.

At \$300/oz gold, \$5/oz silver, and \$0.90/lb copper, the market value of the metal was about \$340 million. Gold at the Snip Mine was mined in a 1.6 to 50 feet (0.5 to 15 meter) wide high-grade quartz-carbonate-sulfide vein. Vein boundaries were usually sharp with well-defined gold values. The dip length of the deposit was about 1,640 feet (500 meters) and the strike length about 3,281 feet (1,000 meters).

Operational access to the Snip Mine was from Wrangell by hovercraft along the Iskut River and aircraft by an airfield adjacent to the mine. The hovercraft hauled out concentrates and backhauled fuel and supplies to the mine from late March to early November. Due to complaints about fish being thrown onto the banks and disturbances to flow channels from the hovercraft, fixed-wing aircraft were employed to serve the mine. From Wrangell the concentrates were hauled by barge to Stewart. During the period Snip Mine operated, there were two airplane crashes, resulting in several deaths. The mine closed in 1999.

Barrick Gold does not consider the Snip Mine area to be a high priority, as they are currently exploring over 60 projects in nine countries and drilling on 17 of these projects.<sup>14</sup> Current focus is on a \$340 million gold mine being constructed in Veladero, Argentina. Barrick Gold does not intend to invest further in exploration or access roads to Snip Mine at this time.

Barrick Gold still has a number of paid up claims in the area but their equipment has been moved off site and the mine has been reclaimed.

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<sup>13</sup> Homestake Canada Inc. owned the controlling interest in Prime Resources, who operated Eskay Creek Mine and the Snip Mine with Cominco in the early 1990's. Since then, Barrick Gold purchased Homestake.

<sup>14</sup> Barrick Gold, 3<sup>rd</sup> Quarter Report, 2003.

Clearly, a road to the property would have dramatically reduced development and operational costs for the mine. This would have improved the profitability of the mine and likely prolonged the life of the mine. Lower operating costs allow for mining of lower grade ore which usually results in an increase in the total tonnage of economically recoverable ore. At this stage of the project, the road would reduce reclamation and inspection costs, at a minimum, and would quite likely stimulate renewed exploration in the area.

### **1995 Iskut Road Application**

In 1995, Prime Resources, Snip Mine's operator, submitted an application to the BC government for approval of a 22-mile (35 km) access road to the Snip Mine site, starting at mile 25 (39.7 km) of the Eskay Creek Road. The road was to provide operational access to the Snip Mine and allow Eskay Creek ore to be hauled to the Snip mill for further processing. Prime Resources (Homestake) built the original Eskay Creek Road between 1991 and 1994.

The Eskay Creek Road is a restricted private road with access authorized to others under the BC Mining Rights of Way Act. In 1994, Skyline (see below) was invited by the State of Alaska to apply for up to \$22 million in road construction funding to develop road access to the Tyee Power plant and barge ramp at the head of the Bradfield Canal. The 1995 road application was considered to be an extension to Prime Resources' Eskay Creek mining property discussed below.<sup>15</sup>

The road application was accompanied by a mine development and a hydro power plant application (Forrest Kerr Project) to the BC Environmental Assessment office. The road and mine application were later withdrawn. The power plant application was resubmitted later by Coast Mountain Hydro, and approved by BC in 2003.

### **Skyline Gold (Johnny Mountain)**

Skyline Gold owns the previously operating Johnny Mountain underground gold mine located in the Craig River Valley and has several other properties in the area: Bronson Slope, Stonehouse (Johnny Mountain), Craig River, and McFadden.<sup>16</sup> Skyline Gold operated the Johnny Mountain Mine from August 1988 to August 1990 and periodically in the mid-1990's (e.g., three months in 1993). The mine produced 92,500 ounces of gold, 145,000 ounces of silver, and 2.3 million pounds of copper, yielding revenues of \$45 million.

High operating costs and low gold prices contributed to Johnny Mountain's early shutdown. Access to and from the mine was by air from Wrangell and Bob Quinn using a 5,200-foot long airstrip near the mine site. Air shuttles hauled in supplies and diesel for onsite electricity generators (3,000 gallons per day) and hauled out the gold ore bars and concentrates.

Skyline Gold still has buildings and equipment at the mine site. R&R Enterprises has the right to install additional equipment to mine gold from Johnny Mountain

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<sup>15</sup> Prime Resources Group Inc. (1996) Iskut Road – Phase III Extension to Snip Mine Application For a Special Use Permit Volume I – Summary Report. Page 3.

<sup>16</sup> Skyline Gold Corp. Quarterly & Year End Report 2003.

Mine tailings. Skyline Gold is not currently in a financial position to contribute to building or to commit to using the Bradfield/Iskut River access road.

### **Skyline Gold (Bronson Slope)**

Bronson Slope is the site of a proposed \$98 million gold and copper mine near the former Snip and Johnny Mountain mines and other properties, including Bonanza and McFadden deposits.

Bronson Creek is a porphyry deposit (potential open-pit mine), unlike Johnny Mountain, which was a vein deposit. The property was very active in the mid-1990's. A total of 84 holes totaling 53,500 feet (16,300 meters) have been drilled. Skyline has preliminary plans for a C\$150 million open pit gold and copper mine.<sup>17</sup> Reserves are estimated at 76 million tons with an average grade of 0.015 ounces of gold, 0.16 percent copper, and 0.09 ounces silver per ton. Metallurgical testing indicates recoveries of 79 percent gold, 86 percent copper, and 70 percent silver.<sup>18</sup> A higher-grade 22 million ton starter pit produced grades of 0.018 ounces gold per ton and 0.21 percent copper. A mill rate of 15,000 tons per day is planned. The strip ratio estimate is 0.92 and the ore cost C\$6.92 per ton.

Skyline Gold's plans included concentrate production of 27,000 metric tons (29,700 short tons) per year containing 26 percent copper and 2.3 ounces gold per ton. Plans in the 1990's included construction of an extension of Eskay Creek Road to allow truck transport of concentrates to the rail spur at Kitwanga or to the Port of Stewart for offshore shipment.

With a gold price of \$391 per ounce and a copper price of \$0.91 per pound, the value of the metal is \$32 million per year for gold and \$18 million for copper, for a total of \$50 million per year or \$1,850 per ton. The Skyline project appears to be close to break-even, but requires better ore or lower costs, or both, to proceed.

There were some narrow intercepts of high-grade ore in the area adjacent to the Snip property, but continued Snip Mine operations are not considered worthwhile by Barrick Gold. Upon closure of the Snip Mine in 1998, Skyline and Barrick jointly explored neighboring claims in exchange for a 3 percent net smelter royalty to Barrick on ore discovered. In 1999, Skyline received \$500,000 exploration financing from Royal Gold, Denver, in exchange for a 2 percent net smelter royalty. But the results of these programs were not encouraging enough to proceed. Effective on September 30, 2002, the Skyline Gold Corporation withdrew its application from the BC environmental approval process.<sup>19</sup>

A change in metal prices could result in renewed interest in the Bronson Slope property. Construction of the Bradfield road would benefit the project in two primary ways. First, it would save the mine developer the expense of constructing a resource road link to the existing road at Volcano Creek. Based on an estimated construction cost of \$200,000 per mile, the 22-mile (35 km) extension from Volcano Creek would cost approximately \$4.4 million.

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<sup>17</sup> Skyline Gold, Annual Report, 1995 and Jeff Howett & Associates Inc., Vancouver, BC Research Report, March, 1995.

<sup>18</sup> These grades are lower than BC's Kemess South Mine grading 0.023 ounces gold per ton and 0.23 percent copper.

<sup>19</sup> [http://www.eao.gov.bc.ca/epic/output/html/deploy/epic\\_document\\_21\\_14596.html](http://www.eao.gov.bc.ca/epic/output/html/deploy/epic_document_21_14596.html)

In addition, a Bradfield road would place the property approximately 50 miles from tidewater, compared to the 175 miles via Highway 37 to Stewart. This would reduce the cost of trucking concentrates to a deepwater port (for export to overseas smelters) and the cost of transport of supplies to the mine. For example, if the mine were to produce 100,000 short tons (90,000 mt) of concentrate annually, concentrate trucking cost to Bradfield would total approximately \$750,000 annually, assuming a cost of \$0.15 per ton-mile. Truck transport of concentrates to Stewart would cost approximately \$2.6 million, also based on a cost of \$0.15 per ton-mile. The difference is an annual savings of \$1.5 million. Over a 15-year mine life, savings would total \$22 million.

## **Pamicon Development (Rock & Roll and Niblack)**

Based in Vancouver, Pamicon Development Corporation is a geological consulting company and the main contractor to Abacus Mining & Exploration Corporation (Abacus).

### **Rock & Roll Property**

Pamicon has the Rock & Roll claim about five miles west of the former Snip Mine. Drilling has tested one 82-foot (25-meter) thick horizon over an 820-foot (250-meter) length and down 656 feet (200 meters). Preliminary results indicate reserves for two zones are 580,000 mt grading 3 percent zinc, 0.8 percent lead, 0.64 percent copper, and 0.1 ounce gold per ton over a 2,297-foot (700 meter) strike length.<sup>20</sup> At 80 percent recovery, the market value of these metals is \$18 million for the gold, \$17 million for zinc, \$8 million for the copper, and \$3 million for lead for a total of \$46 million. The ore is of an insufficient grade to be sold directly and the reserves are not large enough to support the investment required for mill and process plant.

### **Niblack Property (Alaska)**

Abacus also has the Niblack copper property in Alaska on the Prince of Wales Island about 30 miles southwest of Ketchikan.<sup>21</sup> The company holds 47 federal land claims, 16 patented (private) claims, and a partial interest in two additional patented claims. A resource of 2.5 million tons grading 1.7 percent copper have been identified, with an estimated market value of the copper of about \$100 million. Approximately \$12 million has been spent drilling and exploring the Niblack property but the company wrote down this investment in 2001.

The Niblack property represents 600 acres of private property and is the largest block of privately held land in Alaska's Tongass National Forest (other than that held by Alaska Native Claims Settlement Act, ANCSA, corporations). Abacus has offered to sell their Niblack holding to the U.S. federal government.<sup>22</sup>

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<sup>20</sup> BC Energy & Mines Mineral File 04/13/94.

<sup>21</sup> Abacus Mining & Exploration Corp., Annual Report, August 18, 2003.

<sup>22</sup> There have been similar examples of land sales in BC, such as the Kemess gold mine, where the BC government made infrastructure investments in exchange for mining companies giving up property.

## **Newcastle Resources (Phiz Property)**

Newcastle Resources is a small Victoria-based public company with several claims held near the former Snip Mine, including the Phiz property.<sup>23</sup> Newcastle Resources is interested and supportive of extending the Iskut River road to the Phiz property.<sup>24</sup>

In 1988, Magenta Development located a vein on the Phiz property averaging about 10 feet (3 meters) in width over a 79-foot (24-meter) strike.<sup>25</sup> Surface samples assayed 1.7 ounces of gold per ton. Thirteen holes have been drilled in the vicinity of the vein. Several quartz pebbles were found in the casing indicating the vein could be shallow. Four holes encountered a broad silicified zone with a width of up to 39 feet (12 meters). Drilling about 150 feet (46 meters) west of the vein intersected a mineralized quartz vein that hosts disseminated galena and pyrite.

The Phiz property is not currently the target of any additional exploration activity. Road access could stimulate renewed interest in exploring the property.

## **Gulf International Minerals (Inel and McLymont Properties)**

Gulf International Minerals (Gulf) is a public company based in London, England. Gulf has a gold mine in Tajikistan<sup>26</sup> and gold properties near the Snip mine.<sup>27</sup> Although Gulf closed their Vancouver office, a former Gulf geologist located in Vancouver continues to represent their interests in BC's Iskut River area.

### **Inel Property**

The Inel property is located near the former Snip Mine in the Jekill Creek drainage. Gulf spent about C\$15 million exploring the Inel property between 1984 and 1991. More than 38,000 feet (11,600 meters) have been drilled. In 1988, a drill hole within the center section returned 0.9 ounces gold per ton over 13 feet (4 meters). Surface diamond drilling, 984 feet (300 meters) in elevation above the portal returned 0.25 ounces per ton over 5 feet (1.5 meters). The underground exploration adit within the North, Center, and South workings has crosscut nine distinct quartz-sulfide gold veins.<sup>28</sup> Of these, one vein returned 2.2 ounces per ton across 2 feet (0.7 meters), and another 0.31 ounces per ton over 7.5 feet (2.3 meters).

In 1989 the Alaska zone was drilled from the surface. The mineralized intrusive breccia was traced over a strike length of 787 feet (240 meters). A drill intersection of 30 feet (9.2 meters) graded 0.63 ounces per ton. The highest gold values seem to be concentrated along one horizon at about the 5,545-foot (1,690 meter) level. This zone

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<sup>23</sup> Newcastle Minerals Ltd., Annual Report, June 30, 2003.

<sup>24</sup> Personal communication, Kevin Whelan, Newcastle Mining, Victoria, BC.

<sup>25</sup> Strike is the course or bearing of a line formed by the intersection of a vein or bed with a horizontal plane, which is perpendicular to the dip. The dip is the angle of inclination, which the vein makes with a horizontal plane.

<sup>26</sup> The Government of Tajikistan owns 51 percent of Gulf's Aprelevka project and provides the deposits, mill, operating rights, and licenses. Gulf owns 49 percent of the project and has management and financial control. The mine operates at a rate of 500 tons of ore per day using 12 leaching tanks. In June 2003, the gold grade was about half the projected grade of 0.3 ounces per ton because limitations in a drill rig forced the company to target lower grade areas with lower strip ratios. New equipment has been ordered to double the mining and milling capacity. The mine should produce about 100,000 ounces of gold next year valued at US\$30 million. The joint venture company employs about 500 workers.

<sup>27</sup> Gulf International Minerals Ltd., Quarterly & Annual Report June 30, 2003.

<sup>28</sup> Adit is a horizontal passage driven from the surface to work a mine or vein.

may extend or repeat into other areas. Indicated reserves of the Alaska zone are 57,600 tons grading 0.41 ounces of gold per ton.<sup>29</sup> At \$300 per ton and 80 percent recovery, this would be valued at \$6 million, not enough to open a new mine or to process at Skyline's former Johnny Mountain Mine, four miles away.

### **McLymont Creek**

Gulf also holds the McLymont Creek gold property on the north side of the Iskut River about 9 miles (15 kilometers) from Volcano Creek. There are numerous quartz-pyrite veins in the quartz rich granite on the central part of this property. Selected pyrite samples from several of these veins have returned good values for gold. However, much less exploration has been carried out at this site, and the results seem less attractive than for the Inel property. In 1987, 12 samples from two trenches averaged 0.1 ounces per ton. A 7-meter sample from one drill hole assayed 0.64 ounces gold per ton.<sup>30</sup>

A Bradfield/Iskut connector road would reduce exploration costs for the Inel and McLymont properties, as well as the numerous other lesser studied prospects or claims in the area.

### **Goldrea Resources (BX Property)**

Goldrea is a small company based in White Rock, BC. Goldrea's main interest is exploring the BX properties in the Iskut River area located 3.75 miles southeast of the former Snip mine.<sup>31</sup> Goldrea's BX property is located about 10 miles past the Volcano Creek road, about halfway to the former Snip mine, and bordered on the west by Snippaker Creek.

There have been numerous surface samples taken over the years and at least eight different companies have maintained claims in the BX area. Some respectable gold values were obtained in some of the veins. In 1991, Noranda explored a 3,940 by 984 foot (1,200 by 300 meter) area in the Ernie Creek area including two drill holes. One of these holes intersected a vertically dipping quartz vein that returned an assay value of 0.08 ounces of gold per ton across a width of 3 feet (1 meter). There have also been some positive results, up to 0.9 ounces of gold per ton from rock samples collected in a nearby 2,297 by 984 foot (700 by 300 meter) area of quartz-sulfide veins.

An aggressive exploration program was conducted in 2003, but none of the three drill holes intersected economic mineralization. Goldrea expects to drill a series of 750 to 900 foot (228 to 274 meter) deep holes to further explore this area in 2004. There are no estimates of reserves for Goldrea's property because there has been only minimal shallow drilling so far.<sup>32</sup> Current access to the BX properties is by helicopter. There was once a CAT trail to the site from Volcano Creek. There are five major creek crossings with the main bridge being at Lehto Creek. However, Goldrea does not have the capital to build a road to its BX property.

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<sup>29</sup> BC Energy & Mines, Minfile 04/13/94

<sup>30</sup> BC Energy & Mines, Minfile 04/13/94

<sup>31</sup> <http://www.goldrea.com/goldrea/eskay.htm>

<sup>32</sup> Paltine Geological, Vancouver, Geological Compilation of BX 1 & 2 Mineral Claims, Iskut River, BC  
[www.goldrea.com/goldrea/eskay/BX%2020Report.pdf](http://www.goldrea.com/goldrea/eskay/BX%2020Report.pdf)

A Bradfield/Iskut road would have immediate benefits, in terms of reduced transportation costs, for Goldrea in its continuing efforts to evaluate the BX property.

### **Ecstall Mining (Gossan 9 Property)**

Ecstall Mining holds the Gossan 9 exploration property on the Craig River about five miles south of the former Snip Mine in the Jekill Creek tributary drainage. The property was first staked in 1982. The company also owns 27 percent of the Bronson Creek property adjoining Skyline Gold's dormant Johnny Mountain gold mine and the former Snip Mine.<sup>33</sup> No exploration activity is planned for the Gossan 9 property in 2004.

In 2003, Ecstall Mining's main exploration activity was on the Dusty Mac former open pit gold mine near Osoyoos, BC. Eldorado Gold Corporation drilled four 656 foot (200 meter) deep holes on the property at a cost of C\$200,000. The company has 12 other gold exploration properties in BC and Quebec and considers their Bronson interest and Gossan 9 property to be relatively low in priority.

### **Imperial Metals (Gossan 10)**

Imperial Metals holds gold exploration properties about four miles west of the former Snip Mine on the west side of the Craig River. It also has an interest in the Bronson Slope property. Imperial's Gossan claims including Gossan 10 are staked but there has been no drilling at these sites. This is a long-term prospect and there are no current plans for exploration in the area.

Imperial Metals owns 50 percent of the Huckleberry mine 76 miles (123 kilometers) southwest of Houston, BC, and 100 percent of the idle Mount Polley, BC mine, 35 miles (56 kilometers) northeast of Williams Lake.<sup>34</sup> Imperial Metals is also exploring the Nak property near Atlin, BC. The main focus of the company is its Sterling gold property in Nevada.

### **Silver Standard Resources (Nickel Mountain)**

Silver Standard has an underground nickel prospect at the head of Snippaker Creek. Exploration, mainly by Sumitomo Metal Mining in 1970, identified 2.9 million tons grading 0.8 percent nickel and 0.6 percent copper.<sup>35</sup> At 80 percent recovery, and \$5.50 per pound, the nickel is valued at \$300 million and the copper at about \$40 million.<sup>36</sup> A second area has reserves of 54 million tons grading 1.53 percent nickel and 0.70 percent copper. Of its \$9 million mineral property investments in 2003, about 40 percent were in Chile, 20 percent in Australia, 20 percent US, and 10 percent Mexico.<sup>37</sup> The company is focused on gold and silver.

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<sup>33</sup> Ecstall Mining Corp., Annual Information Form, BC Securities Commission, June 2, 2003.

<sup>34</sup> Imperial Metals Corp., Vancouver, Second Quarter Report, June 30, 2003 and News Release Nov. 28, 2003.

<sup>35</sup> BC Energy & Mines Minfile Report Revised 12-Feb-90.

<sup>36</sup> For comparison, Inco's Voisey Bay Labrador surface nickel mining project is much richer. Voisey Bay has reserves of 30 million tons grading 2.8 percent nickel and 1.7 percent copper.

<sup>37</sup> Silver Standard Resources Inc., Report for Mine Months ended Sept. 30, 2003.



Silver Standard's Nickel Mountain property is not mentioned in the company's annual report but it does note that BC exploration in general is of low priority.

### **Rimfire Minerals (RDN Property)**

Rimfire Minerals' RDN property is in the Iskut River Valley 25 miles (40 km) north of the Eskay Creek mine, in the upper reaches of Forest Kerr Creek. Rimfire's properties consist of 273 contiguous claims, which are 13 miles (23 km) long and are underlain with similar stratigraphy to that of the Eskay Creek deposit.<sup>38</sup> Initial exploration during 1989-92 focused on gold-rich quartz sulphide veins, including drill intersections of 1.95 meters grading 101 grams/tonne (2.95 oz/ton) gold and 0.85 meters grading 138 g/t (4.0 oz/ton) gold.

The RDN property is receiving renewed exploration attention. Rimfire Minerals signed a letter of intent in April 2004 with Barrick Gold for an option on the RDN property. Exploration results over the past two years have been successful in continuing to advance RDN project. The new partnership with Barrick Gold brings Eskay Creek Mine's geological team, which has significant expertise, to the project. The so-called Jungle anomaly is a prime exploration target for further diamond drilling. The property is relatively close to the existing Eskay Creek road.

### **Roca Mines (Foremore Property)**

Roca Mines is small exploration company based in Vancouver. Roca's main exploration effort is the Foremore Project located near the More Glacier, in the upper reaches of More Creek, 28 miles (45 km) west of Bob Quinn and 20 miles (30 km) east of the Galore Creek Project.<sup>39</sup> The original tunneling/road access option for the nearby Galore Creek could potentially help access to the Foremore property.

The More Glacier, which is 1.25-miles (2 km) wide and 6.25 miles (10 km) long, divides into two snouts about 3 miles apart, each marked by extensive outwash moraine containing heavily mineralized boulders. The source of the boulders is a major exploration question. The Foremore property comprises 54 claim blocks (824 units), which encompass an abundance of known precious and base metal rich mineralized boulder fields, mineralized outcrops, and geochemical and geophysical showings in several target areas.

Originally, Cominco staked portions of the current Foremore Property area after the discovery of a gold-rich (5.2 oz./ton Au) quartz boulder and several massive sulphide boulder fields during helicopter reconnaissance in 1987. Exploration work by Cominco consisted of geological mapping, prospecting, rock sampling, soil and stream geochemistry, ground geophysics and diamond drilling to determine the source of over 1000 mineralized boulders. Cominco carried out over C\$2.0 million in work on the property prior to 1997 before the claims lapsed in 1999.

Roca optioned the property and is earning a 100 percent interest in the property by conducting exploration work and by making cash and share payments. In May 2002,

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<sup>38</sup> <http://www.rimfire.bc.ca/s/RDN.asp>

<sup>39</sup> BC Ministry of Energy and Mines (2003)

Wojdak, PGeo. Regional Geologist, Smithers.



Roca began detailed research on the Foremore area geology, a comprehensive data compilation and an air-photo interpretation study. That work resulted in the definition of a number of new target areas for mineralization that had not been recognized by Cominco in the past.

Roca's 2004 focus will be to improve the geological understanding of the North and SG Zones. They plan an extensive diamond drilling program across these zones. Roca is planning to drill upwards of 10,000 meters at its Foremore property in 2004.

## **Surrounding Properties**

### **Eskay Creek Mine**

Discovered in 1988, the Eskay Creek Mine is the only operating mine in the study area as of 2004. The mine is located in Unuk River basin, south of the Iskut River. The Barrick Gold Corporation of Toronto owns the Eskay Creek Mine, which is one of the richest gold mines in the world. Eskay Creek gold/silver production began in 1994. The company's predecessor, Prime Resources or Homestake, built 37 miles (60 kilometers) of road along the Iskut River from Highway 37 to Volcano Creek to access the Eskay Creek Mine.

Eskay Creek is an underground mine approximately 50 air miles (85 kilometers) north of Stewart, BC. Total reserves as of December 31, 2001 were 1.43 million ounces of gold and 64.4 million ounces of silver. The mine started operation in 1995. The current mining plan indicates the mine will be depleted by 2005, although concentrate shipments will continue to the end of 2008.

The company mines 250,000 tons per year with a very rich average grade of 1.4 ounces gold per ton. The mine generates about \$130 million per year and operating costs are about \$50 million per year. Eskay Creek is Barrick Gold Corporation's most profitable gold mine. The mine presently hauls 160,000 tons per year over the Eskay Creek Road to Highway 37, using haul trucks. Shipments are 135,000 tons per year of gold ore and 25,000 tons per year of lead/zinc concentrate over their Eskay Creek Road and down Highways 37 and 37A.<sup>40</sup>

With respect to the 135,000 tons per year of gold ore, Barrick Gold ships about 85,000 tons per year of ore to Noranda's Rouyn, Quebec smelter by rail and 50,000 tons per year to the Dowa Mining Company's smelter in Akita-ken, on the island of Honshu in Japan. The ore for Noranda is loaded at Kitwanga railhead and takes about 12 days to reach the Quebec smelter. The ore for Dowa is loaded at Stewart in single hold lots of 5,000 tons each, in a 30,000 deadweight tonnage (DWT) ship. The 25,000 tons per year of lead/zinc concentrate is loaded at Kitwanga and shipped by rail to Cominco's Trail, BC smelter.

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<sup>40</sup> Eskay Creek Mine Manager. The mine has a sulfide float circuit that produces lead/zinc concentrate.

**Figure III-1  
Eskay Creek Mine Haul Truck on Highway 37**



### **SpectrumGold (Galore Creek)**

SpectrumGold Inc., a subsidiary of NovaGold, is evaluating its Galore Creek gold/silver/copper project. Galore Creek is located at the headwaters of the Scud River, a tributary of the Stikine River. This property is not in the Iskut Valley corridor, but is important because it is a large, advanced exploration project and if developed, could require large tonnage concentrate shipments offshore. Project costs are estimated at C\$400 to C\$650 million and construction is planned to start in 2007.

In 2003, SpectrumGold signed an agreement with subsidiaries of Rio Tinto and Anglo American to acquire a 100 percent interest in the Galore Creek Project by 2010.<sup>41</sup> Under the terms of the agreement, they must complete a pre-feasibility study and make payments totaling \$20.3 million within a period of eight years, at which time the company will own 100 percent interest in the project with no retained royalties or back-in rights.<sup>42</sup>

Galore Creek is one of the largest and highest-grade alkalic intrusive-related gold/silver/copper deposits in North America. Based on the extensive work carried out by Rio Tinto and Anglo American from the early 1960's through 1991, management believes that the system remains open and that the exploration concept would outline a resource of 80 to 150 million tons of material with bulk grades exceeding 0.07 to 0.106 ounces per ton gold equivalent within the larger mineralized system.

Since its discovery in 1960 there have been 439 drill holes totaling 327,000 feet on the property. In 2003, Spectrum completed a 10,000-foot drill core program. Total reserves are estimated at 243 million tons grading 0.75 percent copper and 0.016 ounces gold per ton.<sup>43</sup> This is higher in copper and lower in gold than the operating

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<sup>41</sup> More specifically, QIT-Fer et Titane Inc., Quebec, which is a subsidiary of Rio Tinto and Hudson Bay Mining and Smelting Co. Ltd., which is a subsidiary of Anglo American.

<sup>42</sup> <http://www.novagold.net/s/Projects.asp?>

<sup>43</sup> SpectrumGold Inc., Annual Information Form, Nov. 20, 2003.

Kemess South open pit mine (located in north central BC) of 0.23 percent copper and 0.023 ounces gold per ton.

Spectrum is considering two production alternatives for Galore Creek:

***30,000t/day ore throughput***

- 10.5 million tonnes per year
- 900 tonnes per day concentrate
- 25 trucks at 40 tonnes per load per day
- 315,000 tonnes per year of concentrate
- mine life 30 years

***60,000t/day ore throughput***

- 21 million tonnes per year
- 1,800 tonnes per day concentrate
- 45 trucks at 40 tonnes per load per day
- 630,000 tonnes per year concentrate
- mine life 20-30 years

**Galore Creek Mine Access**

Kennecott Copper built an airstrip at the confluence of the Scud and Stikine Rivers and a 25-mile (40 km) road up the Scud River to serve the Galore Creek property. The shortest route out from the mine would be to build a new 53-mile (85-kilometer) road along More Creek to Highway 37 at Bob Quinn. However, the new road will require three tunnels, the longest 7.5 miles (12 kilometers) in length. The road cost is estimated at US\$70 million (C\$93 million), with about half for the tunnels.<sup>44</sup>

Kennecott had envisioned a 7.5-mile (12 km) conveyor tunnel through the mountains directly above the Galore Creek headwater to the Sphaler Creek drainage, which is an upper tributary of the Porcupine River, south of the Scud River. Access from there would be through additional tunnels and a new road along the Sphaler and More Creeks to Highway 37 near Bob Quinn. For movement of large equipment to the mine site, the existing Scud River tote road would be improved, and heavy equipment would be barged up the Stikine and moved up the Scud River road to the mine site.

In February 2004, SpectrumGold Inc. submitted a report to the BC Assessment Office, which outlines four access options to the proposed mine site<sup>45</sup>:

- Option 1: the exclusive use of the tunnels and Sphaler/More Creek road concept to Highway 37.
- Option 2: the exclusive use of Scud River Road to the Stikine River and transport of all supplies and equipment up the Stikine.
- Option 3: construction of a shorter tunnel to the west into the Porcupine River drainage, down to the Stikine and along the eastern side of the Stikine River out to a newly constructed tide-water port, presumably at the mouth of the Stikine River.

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<sup>45</sup> SpectrumGold Inc. (2004) *Galore Creek Gold-Silver-Copper Project Description*. Figure 4.

- Option 4: Option 3, but at the confluence of the Iskut River, the road heads east up the Iskut River and then south up the Craig River to the Bradfield port facility.

### Revised Options

As a result of opposition to the US port options, SpectrumGold revised its access options, and presented them at the Environmental Assessment Meeting held in Smithers April 5<sup>th</sup> and 6<sup>th</sup>, 2004.

Option 1 represents the original tunneling and road concept down More Creek to Highway 37 north of Bob Quinn. Option 2 is the shorter tunnel alternative into the Porcupine River drainage and construction of a road down and along Stikine River, then east up the Iskut River connecting to the Eskay Creek Road onto Highway 37 near Bob Quinn. Both options assume the use of Stewart for offshore concentrate shipments.

The costs of the two options, as presented by SpectrumGold, are presented below.

**Table III-1**  
**Galore Creek Access Options to Stewart<sup>46</sup>**

	Units	More Creek Option	Iskut River Option
Distance to Port	miles	164	230
New Road/Tunnel	miles	45/11	93/2
Road/Tunnel Costs	\$C millions	38/128	92/21
Power Costs	\$C millions	21	33
Costs at Port	\$C millions	9	9
Total Costs	\$C millions	195	155
Operating Costs	\$C millions	15	21
NPV (8%)	\$C millions	289	301

Source: Nova Gold Resources, Inc.

The present value of the costs of the two options are effectively the same. Therefore other factors may weigh in favor of either option. Although there would be environmental opposition to the Stikine/Iskut road option, the preference of the Tahltan First Nation may be a factor countering this opposition. The Tahltan have a history of participating in resource development projects within their territorial area, including providing road construction and maintenance services to mining companies.

### Bradfield Canal Link

Although excluded in the revised options, the Iskut option in conjunction with the Bradfield Canal road link would reduce the haul distance from 230 miles to 107 miles, which is less than the More Creek haul distance to Stewart of 164 miles.

<sup>46</sup> NovaGold Resources Inc. (2004) *Engineering Studies*. PowerPoint presentation April 5<sup>th</sup> and 6<sup>th</sup>, 2004, Smithers, BC.

Ignoring differences in port costs, the Bradfield Canal option for the Galore Creek project would be lower in cost than any option that sends concentrate to Stewart.

Based on trucking costs of \$0.15 per ton-mile, shipment of 315,000 tons of concentrate via Bradfield would save approximately \$2.7 million annually compared to the More Creek option to Stewart, and \$5.8 million compared to the Iskut River (to Stewart) option. Savings would be about double with annual production of 630,000 tons of concentrate.

**Table III-2**  
**Annual Concentrate Trucking Costs for Galore Creek Access Options**

Annual Concentrate Production (MT)	More Creek Option (164 miles, 264 km)	Iskut Option (230 Miles, 370 km)	Bradfield Option (107 miles, 172 km)
315,000	\$7,750,000	\$10,900,000	\$5,060,000
630,000	\$15,500,000	\$21,800,000	\$10,120,000

Based on US\$0.15 per ton-mile.

Moving 315,000 tons of concentrate annually over a 30-year mine life, trucking via Bradfield would result in a total undiscounted savings of \$81 million compared to the More Creek option to Stewart and \$174 million compared to the Iskut River to Stewart option.

**Table III-3**  
**Galore Creek Concentrate Trucking Cost Savings with Bradfield Access**

Annual Concentrate Production (MT)	Annual Savings compared to More Creek Option	Annual Savings Compared to Iskut Option	Total Savings compared to More Creek Option*	Total Savings Compared to Iskut Option*
315,000	\$2,700,000	\$5,800,000	\$81,000,000	\$174,000,000
630,000	\$5,400,000	\$11,600,000	\$108,000,000	\$232,000,000

\*Based on 30 year mine life at the production rate of 315,000 mt per year and 20 year mine life at 630,000 mt per year.

This savings considers only costs associated with ore concentrate trucking. There would be other savings as well, associated with shipment of fuel and other supplies that could not be back-hauled on the ore concentrate trucks. The magnitude of these cost savings would depend on the origin of the materials (some of which might be trucked from elsewhere on the Canadian road system).

In addition to road/tunnel construction costs and concentrate trucking costs, costs associated with marine terminal construction and operation at Bradfield are critical in the analysis of overall savings associated with Bradfield (an issue discussed in a following section of this report).

### **bcMetal Corporation (Red Chris Property)**

bcMetal Corporation (based in Vancouver, BC) is the primary developer of the Red Chris property, which is another advanced project (although smaller than Galore Creek).<sup>47</sup> The property is 80 percent owned by bcMetals and 20 percent owned by

<sup>47</sup> <http://www.bcmetalcorp.com/>

Teck Cominco, another BC-based mining company that operates the Red Dog Mine in Alaska.

Red Chris is an advanced porphyry copper-gold exploration property, located 11 miles (18 km) south of Iskut. The property is accessible by air or by road off the Ealue Lake Road (Klappan River Road). A rough access road leaves the Klappan Road just west of Ealue Lake, which was used by American Bullion in the 1990's, the previous owner, to infrequently access the Red Chris property. The mine development plan calls for construction of 14 miles (23 km) of new access road to Highway 37. The property is currently about 200 highway miles (322 km) north of Stewart, the closest existing deep-sea port and is approximately 162 highway miles (260 km) from the head of Bradfield Canal.

During September to November 2003, the property underwent an intensive drilling program, which resulting in 16,600 meters drilled over 49 drill holes. In October 2003, bcMetal submitted a Project Description to the BC Environmental Assessment Office, and the company expects to file their Environmental Impact Assessment report as part of their environmental approval application by June 2004. The Red Chris project is compatible with the Stikine-Iskut Land and Resource Plan approved by the BC Cabinet in 2000, therefore no major environmental obstacles are expected. The current C\$150 million project is for an open pit mine, floatation mill, tailings management facility, waste rock stockpile, low grade stockpile, work camp, access road, maintenance shop and power line from Bob Quinn. Mine and plant construction are scheduled to start in 2005 and pre-stripping and production by late 2006.

According to bcMetal, Red Chris is one of the richest undeveloped porphyry copper-gold deposits in BC with 74 million tonnes at a 0.5 percent copper cutoff grade. Recent tonnage and grading estimates are shown in the following table.

**Table III-4**  
**Red Chris Project: Measures, Indicated and Inferred Resources,**  
**April 2004<sup>48</sup>**

Resource	Measured	Indicated	Inferred
0.50 % Cutoff (million mt)	29.8	30.4	14
Copper Grade	0.78 % Cu	0.63% Cu	0.56% Cu
Gold (grams per mt)	0.66 gpt	0.53 gpt	0.41gpt
0.35 % Cut-off million mt)	55.5	112	121.6
Copper Grade	0.61 % Cu	0.47% Cu	0.42% cu
Gold (grams per mt)	0.49 gpt	0.38 gpt	0.36 gpt

The planned material movement is estimated to be 95,000 mt per day with a mill throughput of 25,000 mt per day. Annual production will be 100 million pounds of copper and 72,000 ounces of gold. The copper concentrate grade will be 27 percent with 19 grams of gold per ton. With strong smelter demand for concentrates, the company expects to ship concentrates to Japan, Korea, China, India and rest of the world.

<sup>48</sup> BcMetals Corporation (2004) *Red Chris Copper-Gold Porphyry Deposit*, April 2004 PowerPoint Presentation

bcMetals has signed a Memorandum of Understanding with the Tahltan and Iskut First Nations, which identifies shared resource development objectives. The Tahltan and Iskut First Nations are supportive of the Red Chris project and will share in the benefits from the project, including employment opportunities. The Tahltan have expressed interest in providing road development and maintenance services to bcMetals, including trucking of mine supplies and concentrates to port. The Tahltans have had prior experience working at the Eskay Creek and Golden Bear mines and on BC government road contracts.

Shipping concentrates through Bradfield rather than Stewart would result in substantially reduced trucking costs, assuming the concentrates would be shipped overseas. A deepwater port at the head of Bradfield Canal would be 39 miles closer than Stewart to the Red Chris. At a cost of \$0.15 per ton mile, the Bradfield trucking cost savings would be \$1.2 million annually, based on an estimated 200,000 tons of concentrate shipped each year (excluding differences in port fees).

### **Kerr Sulphurets Properties**

The Kerr-Sulphurets projects are located in the headwaters of the Sulphurets Creek, a tributary of the Unuk River, approximately 16 miles southeast of the Eskay Creek mine. In 1996, Placer Dome's engineering group completed a preliminary economic evaluation of the project whereby both deposits were incorporated into one mining operation.

Noranda Exploration carried out geological mapping and sampling work on the Kerr Sulphurets property acquired from Seabridge Gold Inc. The property contains the Kerr porphyry copper-gold deposit and the Sulphurets gold work. Work will continue in 2004 and may include core drilling.<sup>49</sup>

Seabridge Gold Inc. purchased the Kerr Project from Placer Dome in 2001.<sup>50</sup> In 2002, Noranda purchased an exploration option in the Kerr Project. Seabridge and Noranda intend to conduct reclamation and exploration activity until 2008.<sup>51</sup> The Kerr deposit was modeled by Placer Dome as a copper/gold porphyry system with total measured, indicated, and inferred resources estimated at 140.8 million tons grading 0.75 percent copper (2.3 billion pounds of copper) and 0.36 grams of gold (1.6 million ounces of gold) per ton at a 0.40 percent copper grade cut-off. Of this resource, Placer Dome classified 74.0 million tons grading 0.34 grams of gold per ton and 0.74 percent copper as drill-indicated.

Current access to the Kerr-Sulphurets property is by helicopter from Stewart. Mobilization of equipment can be staged from the nearby airstrips, including Bob Quinn and Bell II Crossing on Highway 37.

Previous ground access was by a 4-mile forestry road from Highway 37 to the east end of Bowser Lake, by barge or ice road to the west end of Bowser Lake, and 14 miles of road to the edge of Knipple Glacier and an 11-mile road over the glacier to the Sulphurets Project at Brucejack Lake.

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<sup>49</sup> BC Ministry of Energy and Mines (2003) *Exploration and Mining in British Columbia-2003: Northwest Region*. Paul Wojdak, PGeo. Regional Geologist, Smithers.

<sup>50</sup> <http://www.seabridgegold.net/sulphurets.htm>

<sup>51</sup> BC Ministry of Energy and Mines (2002) "Noranda Returns to BC as Business Climate Improves" September 17, 2002. News Release. Also <http://www.seabridgegold.net/kerr.html>.



If the Kerr Sulphurets properties were developed, this previous ground access route would be reopened rather than using the Bradfield/Iskut corridor due to the adverse terrain. Access from the east would place the projects significantly closer to Stewart than Bradfield.

## **Heritage Exploration Ltd**

### **SIB Claims**

Heritage Explorations holds varying exploration interests, totaling approximately 47,000 hectares in and around the operating Eskay Creek Gold Mine, accessible via the Eskay Creek Mine road.<sup>52</sup>

Heritage Explorations Ltd. holds the SIB claims, which lie south and are adjacent to the producing Eskay Creek Mine. From 1989 to 2002, 113 drill holes were completed on the SIB property, and numerous encouraging intersections were encountered including the Lulu and Battleship Knoll Zones. Drilling and 3D modeling were conducted.

### **Other Heritage Properties**

Heritage Explorations Ltd. also holds the Bonsai Joint Venture Area, the Treaty Creek Joint Venture Area and their Heritage Claims (100 percent owned) comprising the Polo, Megan, Skookum, Rambo, Fog, Sto, John and Lance claims. Based on the exploration that has been carried out to date on these claims, most are regarded as prospects for gold mineralization. Heritage Explorations Ltd. holds a 100 percent interest in the Glenfred Claims and Leases covering a total of 46,700 hectares, as well as 50 percent of the Teuton Joint Ventures, which covers two separate areas.

### **Klappan Coal**

The Mount Klappan properties are located near the headwaters of Little Klappan River. Mount Klappan is the site of four large undeveloped anthracite coal reserves, which are located northeast of the Eskay Creek road intersection with Highway 37. The Mount Klappan deposits contain measured and indicated resources of 234 million tons and inferred and speculative resources of 2.6 billion tons of anthracite coal. Through the 1980's, extensive exploration was conducted, which included a 100,000 ton trial shipment to domestic and offshore customers. In 1986, Klappan coal was shipped to Britain and Korea. Later in 1987, coal was shipped to Quebec Iron and Titanium in Quebec. These shipments were trucked over the existing circuitous road route and shipped through the Port of Stewart.

The latest feasibility study on Mount Klappan in 1991 estimated in-pit mining reserves for the proposed Lost Fox mine of 51.5 million tons of high-quality anthracite coal. The mine feasibility study indicated that this in-pit reserve could support production of 1.7 million tons per year over an assumed 21-year mine life.

In 2002, Fortune Minerals Ltd. of London, Ontario purchased 100 percent interest in the Mount Klappan anthracite coal project from Conoco Canada Resources.<sup>53</sup> With

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<sup>52</sup> <http://www.heritageexploration.com/mineralproperties.asp>



increased coal prices, Fortune Minerals is assessing the project as well as pursuing renewed marketing activities. Fortune Minerals said that originally, 60 percent of the coal would be sold offshore. They now expect that most would be sold in the North American market.<sup>54</sup>

### **Klappan Access Options**

Rail access is the preferred option for Klappan. Construction of the Dease Lake rail extension began in 1967 from O'Dell station, just north of Prince George, and was completed to Fort St. James in 1968. The province then decided to extend the rail line to Dease Lake, which became known as the Dease Lake extension. The long-term political intention was to eventually interconnect to the Alaska rail system. Construction proceeded from Fort St. James along Takla Lake and the right-of-way and rail grading were completed all the way to Dease Lake. Although the project was not completed, tracks were installed as far as Chipmunk Station, which is approximately 44 miles south of Mount Klappan. Currently, seasonal rail service is provided to Minaret Station, south of Chipmunk Station, which is used to haul timber to Prince George mills.<sup>55</sup>

The Dease Lake rail bed runs beside the Mount Klappan coal properties. According to Fortune Minerals, their preferred access option is to transport coal from the Mount Klappan project using the existing rail bed. Rail service on the operating segment of the Dease Lake extension currently runs only 240 days per year. Fortune Minerals also mentioned that CN Rail could construct a shorter rail line to Hazelton to connect more directly to the CN main line.

**Figure III-2  
Dease Lake Extension Rail Bed**



<sup>53</sup> Fortune Minerals Limited (2003). The Mount Klappan Coal Project – Project Description.

<sup>54</sup> Personal communication with Robin Goad, M.Sc. P.Geo. President, Fortune Minerals Limited, London Ontario, March 2, 2003.

<sup>55</sup> [http://www.repjames.org/Transport\\_Canada.pdf](http://www.repjames.org/Transport_Canada.pdf).

Fortune Minerals indicated that their second access option would be to transport coal by road. Currently, a 74-mile gravel road from Highway 37 from the north near Iskut provides access to Mount Klappan. Trial coal shipments in the 1980's were transported by this road to Stewart, a road distance of 264 miles. To shorten the haul distance, a 62-mile cut-off road was proposed along the Bell Irving River, which would intersect Highway 37 near the resort at Bell II. This cut-off road would reduce the distance to Stewart from 264 to 156 miles. Original road costs were estimated to be over C\$100 million; however, Fortune Minerals envisions a less costly single-lane radio-controlled industrial road, which would cost about C\$20 million.

**Table III-5  
Mount Klappan Road Distances to Tidewater**

Route	Without Short-cut	With Short-Cut
Mount Klappan to Stewart	264 miles	156 miles
Mount Klappan to Bradfield Canal	225 miles	179 miles

Without the cut-off road, the Bradfield/Iskut road would reduce the distance from Mount Klappan to tidewater from 264 miles to Stewart to 225 miles to tidewater at Bradfield Canal. With the proposed 62-mile cut-off road, the Bradfield-Iskut road would be 179 miles to tidewater at Bradfield Canal, which is a slightly longer distance than to Stewart at 156 miles.

Given the proximity of the rail bed and the operating rail line to the south, Fortune Minerals has indicated their most cost-effective option would be to transport coal by CN Rail. This could involve using the existing rail bed that runs by their property, hauling coal 44 miles by truck and loading coal at Chipmunk Station. With increased volume it may be feasible to extend the track directly to the mine site.

Once on the CN Rail system, the coal can be shipped to North American customers directly or to offshore customers through the Ridley Island coal terminal at Prince Rupert. The only drawback to this option is that the operating segment of the Dease Lake extension runs only 240 days per year. For year-round service the rail bed would need to be strengthened or a southern short-cut constructed to Hazelton to more directly connect to the CN Rail line, whichever of the two options is most cost-effective.

With the Bradfield/Iskut road, the Klappan short-cut road route would be 179 miles to tidewater at Bradford Canal, slightly longer than the 156 miles via Stewart. Fortune Minerals indicates that it expects that 90 percent of its coal sales would be to North American markets, which favors the rail option over the road option. If the majority of coal sales are transported by rail, Fortune Minerals may choose not to build the short-cut road. Under this scenario, the Bradfield-Iskut could still be a viable option for the estimated 10 percent of offshore sales (170,000 tons per year).

## **Analysis and Summary of Mining Industry Benefits**

The mining industry would potentially benefit from construction of the Bradfield/Iskut road in several ways. These include:

- **Reduced exploration and development costs** for those projects that would otherwise require air support or privately-financed pioneer road construction.
- **Reduced costs for truck transportation of ore and/or concentrates** to tidewater, for projects in the Iskut Valley and projects north of Bob Quinn. This applies for concentrates destined offshore (e.g., Japan and Asia). North American smelters are more competitively served by rail rather than by ship, therefore concentrate heading to North America smelters would not need tidewater access. These shipments would be transported down Highway 37 to the railhead at Kitwanga.
- **Reduced costs associated with trucking fuel, chemical reagents, and other materials** could also be realized with better access to tide water.
- Improved access through the Iskut valley would also be likely to **increase exploration activity in the area**, increasing the likelihood of additional discoveries in this richly mineralized region.
- **Increased valuation of claims in the Iskut area**, as a result of improved access. If the Iskut road were built it would tend to increase the value of the Iskut Valley mining properties, since this would reduce their costs and improve their viability. Thus, with the road in place one would expect that undeveloped properties would sell for higher value, due to the existence of road access.

All of these potential benefits are important, but from a highway benefit/cost perspective, the most important benefits would be those that stem from savings associated with moving very large tonnages or concentrates or supplies. In the preceding analyses, annual savings of several million dollars were identified for the Galore Creek and Red Chris projects, if concentrates were trucked to Bradfield rather than Stewart. It is possible that such savings could be a decisive factor in overall mine feasibility. If it were the decisive factor, the benefit that could be attributed to the road would include all of the economic activity associated with mine development and operations, potentially hundreds of millions or even billions of dollars in expenditures and net production values.

In other cases, the benefit of the road would be a function of reduced mine operating costs stemming from reduced (compared to trucking to Stewart) transportation costs, as described above. In this case, total benefits attributable to the mine are the present value of annual savings for the life of the mining project. For example, annual savings of \$1 million, over a 20-year mine life, would have a present value of \$10.6 million, based on a discount rate of 7 percent.

An important consideration in this analysis, however, is the cost of constructing and operating a concentrate loading facility at the head of Bradfield Canal. Stewart, while some distance farther than Bradfield for mining projects in the Iskut and Highway 37 areas, has the advantage of an operating, fully functional marine terminal. The bulk terminal loader at Stewart is designed for loading mineral concentrates and is capable of loading 60,000 DWT vessels. In 2001, 210,000 mt were loaded by a fixed

conveyor swing loader. The bulk terminal loader has a capacity of 300 to 500 mt per hour.

The port can handle vessels up to 800 feet (244m) in length, with a beam of 100 feet (30.5 m) and draft of 37 feet (11.5m). The port also has a separate loading dock for ocean going barges. Although the facility loads about 14 ships a year, the terminal is only operated at about 10 percent capacity.<sup>56</sup> Stewart Bulk Terminals is a private operation with estimated costs between \$3.00 and \$4.00/mt at volumes of less than 100,000 mt/year.<sup>57</sup>

**Figure III-3**  
**Bulk Terminal Loader, Stewart, BC**



The economics associated with development of a raw ore or concentrate loading facility at the head of Bradfield Canal would depend on the cost of construction and terminal operations, and the volume of material moved through the port. In addition to truck haul costs, often the single biggest factor influencing overall transport costs are the port charges. These costs can vary by a number of factors, a major one being if the port is privately or publicly operated.

Development plans for the Bradfield marine terminal include a ferry/small cruise ship terminal only. Any movement of cargo or resources through Bradfield would require additional private sector investment in port or upland facilities.

With a dock alone, self-loading barges or ships could be used to load relatively small volumes of ore or concentrate, such as might be produced by a small gold mine (the scale of Snip, for example).

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<sup>56</sup> [http://www.thebcwestcoast.com/article\\_portstewart.htm](http://www.thebcwestcoast.com/article_portstewart.htm)

<sup>57</sup> Estimate based on discussions with Stewart Bulk Terminals in 2002, regarding the costs of loading aggregate and crushed ore. This estimate excludes dock side storage costs. The ship operator charges demurrage, pilot and tug costs.



To handle large volumes of concentrate, a larger facility would be required including covered concentrate storage sheds and a ship loader conveyor system. Concentrates generally need to be stored in a covered building prior to shipments, whereas gold ore may not need to be covered prior to shipment. This facility would also require infrastructure costs (power, communications utilities, water), and accommodation for the operators (given there is no nearby community).

The cost to construct storage sheds and install a conveyor system would of course depend on the scale of the operation. The most likely scenario for development of an ore handling facility at Bradfield is mining company investment in a facility that would be privately owned and operated. A mining company would consider several factors in a decision to truck concentrates to Bradfield, including distance to the port compared to Stewart, the volume of material to be transported, the material's handling requirements, road maintenance costs, loading and port charges at Stewart, and costs to build and operate loading facilities at Bradfield. If the cost to build and operate such is terminal is lower than the cost to truck concentrates to Stewart, port development could occur.

### **Concentrate Haul Costs**

Haul costs used in this analysis are based in part on costs for hauling copper concentrate from the operating Kemess mine to Mackenzie, BC. The Kemess mining and milling complex is located 270 miles (430 km) northwest of Prince George. The mine consists of the Kemess South open pit mine and a 50,000 mt per day mill.



Kemess gold-copper concentrate is trucked by gravel road to a rail spur at Mackenzie, BC and fuel and grinding balls are backhauled to the mine site. Kemess concentrate contains 20 to 26 percent copper and 50 to 150 grams gold per mt of concentrate.

The Kemess mine manager indicated that in late 2001 it cost C\$31.00 per mt to haul concentrate from Kemess to Mackenzie, a distance of 242 miles (388 km). The quote is based on a trucking contract with Lomak Trucking, using specially designed trucks. The Lomak tridem (triple drive axles) hauls 46 mt off road and is permitted for 41 mt on the highway. Similar specialized trucks would be used for any mining development in the BC north.

The cost of \$C31.00/mt for an off-highway load of 46 mt is equivalent to:  $C\$31.00 / 1.30 = \$23.85/\text{mt}$  or  $\$21.63$  per short ton for 242.5 miles. Therefore the cost per ton-mile is  $\$21.63 / 242.5 = \$0.09$  per ton-mile or about  $\$0.12$  per ton-mile for highway legal loads of 41 mt (37.2 tons). Canadian trucks can haul greater loads than US trucks due to bridge design limits and other differences.

If the trucks are limited to the standard US load restriction of an 80,000 lb. maximum Gross Vehicle Weight on the US portion of the Bradfield-Iskut road, the payload would be smaller. Based on a 30 ton payload (assumed payload for 80,000 lb maximum GVW truck) the cost per ton-mile would be in the order of  $\$0.15$  per ton-mile.

Therefore based on the Kemess information, haul costs would likely range between \$0.12 per ton-mile for highway loads of 41 mt (37.2 tons) on Highway 37 and \$0.15 per ton-mile if a 30-ton load limit applied (e.g. on the US portion of the Bradfield/Iskut road).

**Transport Canada Study:** A Transport Canada study of trucking costs in Canada dated 2000 indicates a cost of C\$2.50/km, for several 8-axle highway truck configurations operating in BC.<sup>58</sup> Assuming that gravel operation and higher diesel costs would add 25 percent to the highway operation costs, then costs could be on the order of C\$3.13/km or US\$3.85/mile.

Assuming a 41 mt (45.2 st) payload, the Transport Canada costs are equivalent to \$0.09/ton-mile for highway operation, which is lower than the Kemess based cost of \$0.12 per ton-mile for BC legal loads.

If the payload were restricted to 30 tons (27.2 mt), the cost would be \$0.13 per ton-mile. The Transportation Canada study provides some credibility to the Kemess concentrate costs applying to a new mine in the Highway 37 area.

In summary, these historical analyses suggest trucking costs on the order of about \$0.10 to \$0.13 per ton-mile. However, given the recent surge in fuel prices, a slightly higher average, \$0.15 per ton-mile, has been used in this study.

### **Bradfield versus Stewart Port Analysis**

As indicated above, a mining company's decision to use the existing Stewart bulk loading terminal or develop a new facility would depend on a number of factors, including the cost to develop and operate a Bradfield facility, the charges to use the Stewart facility, and the capacity for Stewart to meet the physical needs of the mine (in terms of storage and loading capacity). It is beyond the scope of this study to consider these factors for the several mine development projects that might face this decision.

For illustrative purposes only, it is assumed that a deep water port facility could cost US\$30 million. This construction cost estimate is a very broad estimate based on similar port development projects in Alaska, including deepwater dock (\$10 million), concentrate storage warehouse and related uplands development (\$5 million), and concentrate loading conveyor and related equipment (\$15 million), for a total cost of \$30 million.

Annualized at a rate of 10 percent over a 20-year mine life, port development would have an annual cost of \$3.5 million. Based on \$15 per ton-mile shipping costs, trucking 300,000 tons of ore to Stewart from the Red Chris mine, for example, would cost \$3 million more annually than trucking to a Bradfield terminal. In addition, port fees at Stewart (assumed for purposes of this analysis to be \$3/mt) would add another \$900,000 in annual costs, bringing total Stewart shipment-related costs to \$3.9 million annually. This suggests that the economics between the two alternatives could be closely matched.

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<sup>58</sup> Transport Canada (2000) *Operating Costs of Trucks in Canada - 2000*. Prepared by Trimac Logistics, Ltd. Calgary, Alberta. Page 39.

Development of a Bradfield port could potentially have major benefits for the proposed Galore Creek Mine. As described above, concentrate trucking costs savings associated with use of a Bradfield road to reach tidewater rather than the Stewart terminal could total from \$2.7 million to nearly \$12 million annually, depending on the volume of concentrates produced each year and the alternative route used (Iskut route of More Creek option). Even with substantial port development costs, transport of concentrates to Bradfield could result in savings of several million dollars annually, for larger scale operations.

A definitive answer regarding the choice between Bradfield and Stewart would be mining project-specific, based on very detailed analysis of engineering factors associated with new port development, negotiated fees for use of the Stewart facility, back-haul opportunities and economics, and a myriad of other factors.

## **Mining Industry Outlook**

Mining activity in British Columbia is influenced by market conditions (i.e. metal prices), which vary by cyclical and world economic conditions. In the 1970's, there were high levels of exploration expenditures and many new mines opened in BC. In 1979 there were about 23 metal mines in operation, which declined to nine operating mines in 2001. The current government is intent on attracting more mining company investment to BC.

Since late 2001, commodity prices have rebounded and prices are expected to continue to improve as the demand for resources increases with synchronized recovery of most globally significant economies. Commodity prices are benefiting from the economic recovery. Over the last two years gold prices have rallied from \$300 per ounce in 2001 to the current price of around \$400 per ounce.

This expectation of continuing price firming is due to a number of factors, perhaps the most significant of which is China's industrial revolution. Strong economic growth in China is drawing in metal, scrap and concentrates. China has now overtaken the US as the largest industrial consumer of iron ore, steel and copper. Urbanization of the Chinese population and government commitments to infrastructure spending will be significant factors in the demand for basic commodities.

Gold prices have been rising against financial assets, particularly those denominated in US dollars. Essentially, gold acts as an alternative currency and store of value when the world's reserve currency suffers a loss of confidence. It is possible that the US dollar could continue to lose ground against other currencies, driven by the growing US trade deficit and increasing budget deficit. These conditions indicate that gold prices will increase as the market seeks defensive alternatives to the weakening US currency.

Canadian mining companies are impacted by this because they rely on commodity exports priced in US dollars, so the deflation in the US dollar has reduced the increase in gold prices to Canadian companies. The upside of the depreciation of the US dollar is that US imports into Canada, such as mining equipment and machinery, will be cheaper and will improve labor productivity once installed.

The firming metal prices will likely sustain mining companies continuing to invest in mining developments, such as Galore Creek, as well maintaining interest in resuming development in certain properties in the Iskut Valley. The clear consensus is that the road extension west along the Iskut River would be beneficial to the mining companies – it would reduce their costs of access and improve the likelihood of new mining activity. This is a positive development, especially in light of the buoyant gold prices, which makes it easier for gold mining companies to obtain financing.<sup>59</sup>

## **Mining Industry Benefits Summary**

For purposes of benefit/cost analysis, it is assumed that development of the Bradfield/Iskut corridor would have a net annual benefit, for a large-scale mining project, of \$5 million over a presumed mine life of 30 years, with movement of concentrates and supplies commencing in 2011. . At this time, the Galore Creek project appears to be the development most likely to occur, though with improved access other projects could emerge.

It is further assumed that an annual benefit of \$2 million will be realized from improved exploration access to the Iskut area. This estimate is intended to represent savings from lower-cost surface access to the highly mineralized Iskut area.

It is clear that there is a great deal of uncertainty about the magnitude, timing and duration of mining industry benefits associated with Bradfield/Iskut corridor development. It is possible that large-scale mine development might not occur in the area at all (due to resource limitations or market conditions), even with road construction. Alternatively, it is possible that the improved access afforded by road construction would make feasible an otherwise uneconomic project. If that is the case, the benefits are far greater than the \$7 million annually assumed in this study.

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<sup>59</sup> Financial Post (2004) “Gold prices draws miners back to the North”, Page FP6, January 12, 2004.



## **IV. FOREST PRODUCTS INDUSTRY BENEFITS**

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### **The British Columbia Forest Products Industry**

In British Columbia, public forestland is administered by the BC Ministry of Forests. Most of the public forestland is divided into 43 Timber Supply Areas (TSAs). TSAs are timber volume apportioned tenures shared between companies and 34 Tree Farm Licences (TFLs), which are area-based tenures generally operated by a single licensee or company.<sup>60</sup> Under this timber administration system the Chief Forester determines the maximum harvesting rates, referred to as the Annual Allowable Cut (AAC), which is set, reviewed and determined every five years, under authority of Section 8 of the BC Forest Act.

#### **Cassiar Timber Supply Area**

The area in the extreme northwest of BC, bordering Southeast Alaska, is known as the Cassiar Timber Supply Area (TSA). The Cassiar TSA represents a large area, but is characterized by a small productive land base and generally low timber values. The timber profile is a saw log/pulp log split that occurs primarily in pine/spruce and mature hemlock stands. Stands suitable for timber harvesting are scattered throughout the TSA, with the more recently harvested in the accessible areas around Bob Quinn and the Klappan.

In general, there is little timber harvesting and no permanent timber processing facilities in the TSA. All the timber harvested is hauled south to be exported or processed in mills along the Highway 16 corridor.

The Cassiar TSA is the largest in BC at over 36.5 million acres (14.8 million hectares), covering approximately one-sixth of the total province. However, about 75 percent of the Cassiar TSA is unforested tundra, rock and alpine areas, leaving less than 9 million acres (3.7 million hectares) as forested area. After deducting environmentally sensitive areas and unmerchantable-forested areas, less than 1.25 percent of the TSA is available for timber harvesting.

Forest resources in the Cassiar TSA range from the coastal forests in the west to the extensive slow-growing boreal forest that constitutes the majority of the TSA. Lodgepole pine stands dominate the majority of the TSA, representing about 50 percent of the harvestable land base, while white spruce dominates about 47 percent, mainly in the southern portion. Other species include sub-alpine fir, Sitka spruce, black spruce, Roche spruce, western and mountain hemlock, as well as cottonwood, aspen and birch.

Effective 2002, the Cassiar TSA annual allowable cut, AAC, was reduced to 305,000 m<sup>3</sup>/yr (130 million board feet, mmbf), a decrease of 95,000 m<sup>3</sup>/yr (40 mmbf) from the 1996 AAC set at 400,000 m<sup>3</sup>/yr (170 mmbf). The AAC establishes the maximum permissible harvest rate; however, access, environmental and economic constraints generally result in a significant undercut. The Cassiar is divided into three timber

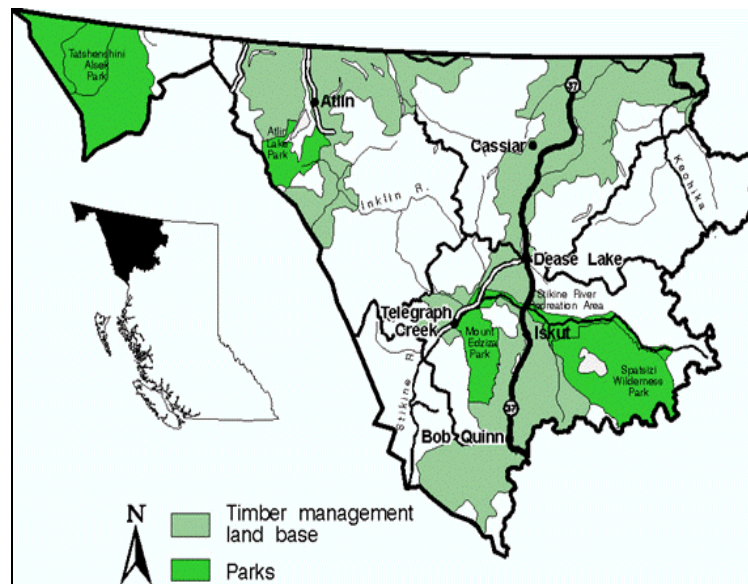
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<sup>60</sup> See TSA map: <http://www.for.gov.bc.ca/ftp/hth/external/!Publish/timten-links-downloads/prov-map/tfl-key-map.pdf>

supply block areas – the Iskut-Boundary to the south, the Dease-Liard to the east and the Atlin supply block to the north, designated by the black boundaries in Figure IV-1. The 305,000 m<sup>3</sup>/yr. (130 mmbf) harvest level is divided between the three supply blocks as follows.

- 120,000 m<sup>3</sup> (50 mmbf) to the Iskut-Boundary timber supply block (40%).
- 153,000 m<sup>3</sup> (65 mmbf) to the Dease-Liard timber supply block (50%).
- 32,000 m<sup>3</sup> (14 mmbf) to the Atlin timber supply block (10%).

**Figure IV-1**  
**Cassiar Timber Supply Area – Iskut Boundary Supply Block**



### Tahltan-Iskut Forest License

First Nations people make up most of the population who reside permanently in the Cassiar TSA. The Tahltan, Kaska Dena, Teslin Tlingit, Taku River Tlingit, and Champagne - Aishihik First Nations comprise approximately 55 to 65 percent of the total population. These, along with First Nations based in the Yukon, have traditional territory within the Cassiar TSA. The Bradfield/Iskut road is in Iskut-Boundary Supply Block (the TSA is divided into smaller supply blocks), which is part of the Tahltans' traditional territory.

In February 2002, the BC Ministry of Forests granted a non-replaceable forest license to the Tahltan and Iskut Bands of the Tahltan First Nation for 120,000 m<sup>3</sup>/yr (50 mmbf) which is valid for a 10-year period in the Iskut-Boundary Timber Supply Block.<sup>61</sup> This license includes the Bob Quinn area to the Coast and the Bradfield/Iskut Road corridor, and is 100 percent exportable. This means that all timber may be exported in log form for prices higher than what many domestic

<sup>61</sup> BC Ministry of Forests, Apportionment System TSA AAC, Apportionments and Commitments: Cassiar TSA, Northern Forest Region, And Forest Licenses Non-Replaceable.

sawmills are willing to pay. This timber volume is from previous under-cut or under-sold volumes and is separate from the current AAC.

Following the collapse of the BC Coastal forest industry, little timber harvesting has taken place in the Cassiar TSA. With high operating costs, remoteness and marginal timber values, the high stumpage rates make it uneconomic to harvest timber in the Cassiar. This is evidenced by the fact that the average annual timber harvest in the TSA from 1996 to 1999 was 25,500 m<sup>3</sup>/yr. (11 mmbf), which is about 5 percent of the 400,000 m<sup>3</sup>/yr (170 mmbf) AAC during 1996 to 2001.<sup>62</sup> Most of the timber that is harvested is exported, which generates higher returns as compared to selling to domestic sawmills, very few of which are currently operating west of Smithers.

Spurred on by a low stumpage rates applying to an initial volume (e.g. pulp log rate \$0.25/m<sup>3</sup>), approximately 50,000 m<sup>3</sup> (21 mmbf) of the Tahltan Iskut forest licence was harvested during the winter of 2002-03.<sup>63</sup> Most of this timber was pine and spruce taken from the west side of Highway 37 near Bob Quinn along the first part of the Eskay Creek road area. This timber was hauled south to Stewart and loaded on self-loading ships.

The Ministry of Forests has indicated that the Tahltan and Iskut Bands have not filed a 'development plan' for approval, which is required before they can continue harvesting under their 1.2 million-m<sup>3</sup> (500 mmbf) license over the 10 years.<sup>64</sup> Further stumpage relief is probably necessary before additional harvesting would be viable.

## **Iskut Valley Timber**

The Iskut Valley covers several biogeoclimatic zones, which influence tree species and, indirectly, timber values.<sup>65</sup> The Coastal Mountain Hemlock zone breaks through the Coast Mountains and covers the low elevations along the lower reaches of the Iskut River. This is very high rainfall area, with cool summers and mild winters. Western hemlock is the dominant species, but some Sitka spruce and lodgepole pine are also found. Above the Coastal Western Hemlock zone is the Mountain Hemlock zone, characterized by short, cool summers and long, cool, and wet winters, with heavy snowfall cover for several months. Mountain hemlock is the dominant species, with some Sitka spruce, Roche spruce, western hemlock and some sub-alpine fir.

In the central portion of the Iskut River, at lower and middle elevations, is the Interior Cedar-Hemlock zone. This zone is characterized by cool, wet winters and warm, dry summers. Again hemlock is the dominant tree species in this zone, but subalpine fir, Roche spruce and occasionally western red cedar also occur. The area is a hemlock transition zone to the interior species at higher elevations along the Iskut River Valley. According to a regional forester, the Iskut Valley is a "climax" forest, which should have been logged decades ago to encourage more vigorous second growth forest.

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<sup>62</sup> BC Ministry of Forests (2001) Cassiar Timber Supply Area Analysis Report, Page 59. See Web site at <http://www.for.gov.bc.ca/hts/tsa/tsa04/tsr2/analysis.pdf>

<sup>63</sup> Pers. Comm. January 14, 2004. Ministry of Forests, Smithers, Phil Madelay. The stumpage relief was authorized by a BC Government Order-in Council.

<sup>64</sup> Pers. Comm. January 14, 2004. Ministry of Forests, Smithers, Phil Madelay

<sup>65</sup> BC Ministry of Forests (2001) Cassiar Timber Supply Area Analysis Report, Page 5.

## Road Corridor Timber

With respect to the timber harvesting potential along the Bradfield-Iskut road corridor, a 20-year old BC Ministry of Forests inventory data for the south side of the Iskut River from Volcano Creek to the Craig River indicates there is about 3 million m<sup>3</sup> of inventory (1.3 bbf). The entire lower Iskut River Valley inventory is estimated to be about 15 million m<sup>3</sup> (6.4 bbf). Most of this volume is in the lower Iskut River valley west of the Craig River (i.e., Coastal Mountain Hemlock zone) and the Snip mine.

Given the age profile of the timber, much of the volume would be considered decadent, and the majority of the trees would not be worth hauling to market. If harvesting were to be conducted, it would likely require selective harvesting of spruce, over the dominant hemlock.

The main forest company who potentially could process timber from the Iskut Valley is West Fraser Timber. The company's sawmill divisions are Pacific Inland Resources based in Smithers, and Skeena Sawmills, based in Terrace, which is not operating. The Smithers mill has no interest in hemlock but the Terrace mill did cut hemlock for Asian markets. The company has considered timber supplies as far north as the Nass River, but timber further north is uneconomic to haul. If timber is harvested in the Cassiar TSA, it is generally exported offshore.

For a variety of reasons there are no current plans to log in the Iskut River valley. The most important constraints appear to be the high stumpage rates and the expense to haul logs south.

## Potential BC Timber Industry Benefits

If the Bradfield-Iskut road were constructed, it would reduce the transport costs of Iskut Valley timber to tidewater access at Bradfield Canal. For example, the distance from the Skyline Gold property to Bradfield Canal would be 44 miles, as opposed to 167 miles to Stewart. Under certain conditions, it may be economically viable to export logs under the Tahltan-Iskut forest licence from Bradfield. The logs could be dumped in the water as they are at Stewart and loaded on board using the ship's own gear.

Based on earlier estimates and recent discussions with Ministry of Forests staff, acknowledging environmental constraints, we have assumed that an annual harvest rate of 15,000 m<sup>3</sup>/yr (6.4 mmbf) could be supported from the 19-mile road corridor between Volcano Creek and the Snip mine.<sup>66,67</sup> The Craig River is a protected area, therefore no harvesting is expected to occur there. A timber inventory report indicates it is about 85 percent low-valued hemlock, 10 percent spruce and 5 percent balsam, cottonwood and pine.<sup>68</sup> Although higher timber values are available on the Lower Iskut, harvesting is not permitted on the Iskut floodplain, west of the Craig River. Strong environmental opposition to timber harvesting in the lower Iskut would be expected, which would reduce the available timber from previous estimates.

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<sup>66</sup> Forestal International Ltd., 1982. Addendum to Stikine-Iskut Forest Impact Study, prepared for BC Hydro & Power Authority, Vancouver, BC.

<sup>67</sup> Ministry of Forests, Bulkley Cassiar District, Claus Rygaard Dease Lake, 2003.

<sup>68</sup> Pers. Comm. Derrick Curtis, Resource Manager, Skeena Cellulose.

Most of the hemlock is decadent and usable only in pulp production, therefore minimum stumpage rates would apply. Because there are no pulp mills operating in Southeast Alaska or at Prince Rupert there is no ready market for chips from these logs. This suggests that few pulp logs would be harvested. The Ministry of Forests estimates stumpage for hemlock would be C\$0.25/m<sup>3</sup> (C\$0.60 per thousand board feet) and spruce about C\$5.00/m<sup>3</sup>. For 10,000m<sup>3</sup>/yr hemlock and 5,000 m<sup>3</sup>/yr spruce, the total stumpage generated would about be US\$22,600 (C\$32,200 per year).<sup>69</sup>

The total economic impact of an annual sawtimber timber harvest of 15,000 m<sup>3</sup>/yr (6.4 mmbf) is estimated at approximately \$1.9 million, based on a value of \$300 per thousand board feet. It is assumed that this harvest would not occur in the absence of the Bradfield/Iskut road. It is also assumed that the road will spur further harvests under the Tahltan license. For purposes of this analysis it is assumed that an average of 15,000 m<sup>3</sup>/yr (6.4 mmbf) would be cut, also with a gross economic value of \$1.9 million. It is assumed that this rate of harvest would occur for a five year period.

An annual harvest rate of 15,000 m<sup>3</sup>/yr (6.4 mmbf) would generate approximately 1,400 truck loads of logs (assuming 4,700 bf per truck load). That is the equivalent of about 8 AADT. Daily logging truck traffic would be higher during the summer months.

### **Other Access Benefits**

The Bradfield/Iskut road potentially reduces fire fighting and pest control costs. Potential savings due to fire fighting access based on average costs in the Skeena Bulkley district are relatively low. Improved road access would likely increase the risk of fires more than the potential savings in fire fighting costs. However, with the projected traffic for this route and proper education, the fire risk due to improved access could be relatively low. Pest control savings are also insignificant because low value hemlock is the predominate species.

## **The Southeast Alaska Forest Products Industry**

The forest products industry had been a key component of the Southeast Alaska economy for 40 years. Historically, the forest products industry accounted for one-third of the region's economy. However, declining Tongass timber harvests in the 1990s, coupled with reduced private harvests, eliminated thousands of jobs and millions of dollars from the regional economy. Today's Southeast timber industry is a fraction of what it was in 1990, when 900 million board feet were harvested annually generating 4,000 jobs. The Tongass and private timber harvest in the region combined now totals less than 200 million board feet annually.

The vast majority of Alaska timber products are barged or shipped to Washington, Oregon, Idaho, California, Canada, and the Asian market. Alaska ranked third

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<sup>69</sup> Stumpage rates based on a recent timber sale for a road realignment of Highway 37: source Claus Rygaard, Ministry of Forests Dease Lake. Species mix based on information from: Forestal International Ltd., 1982. Addendum to Stikine-Iskut Forest Impact Study, prepared for BC Hydro & Power Authority, Vancouver, BC. Further confirmed Ministry of Forests Dease Lake.

(behind Washington and Maine) in the U.S. in terms of exports of forestry and logging products to the world in 2002.<sup>70</sup> More than half, 52 percent, of Alaska 2002 forestry and logging products were shipped to Japan and another 30 percent were shipped to South Korea. Export of timber products to Canada has declined significantly in recent years, falling from \$33 million in 2000 to \$23.3 million in 2001, \$16.5 million in 2002, and \$10.8 million for the first ten months of 2003.

## **Benefits to Alaska Timber Industry**

Development of the Bradfield/Iskut corridor could potentially benefit the Alaska timber industry in several ways. These include:

- Harvest of timber along the highway corridor
- Providing an alternative avenue for moving product out of Southeast Alaska
- Providing another source of timber for processing in Southeast Alaska.

These potential benefits are described below.

## **Timber Harvests in the Bradfield River Valley**

The majority of land in the Bradfield River drainage is national forest. The State of Alaska owns approximately 4,000 acres near the head of Bradfield Canal and in the area of the confluence of the North and East forks of the Bradfield River. According to the Alaska Department of Natural Resources, there are no planned timber sales in the area.

For national forest lands, available data indicates that there were three major timber harvests in the Bradfield area, all between the late 1960s and early 1980s, with approximately 200 mmbf (470,000 m<sup>3</sup>) harvested from 5,400 acres.

Approximately 6,800 acres of forest land remain in the North and East Fork drainages of the Bradfield, with approximately 160 mmbf (375,000 cubic meters) of timber. However, most of this timber is of generally low quality and poor marketability (under current conditions).

There are no timber harvests in the Bradfield area in the Forest Service's current 10-year harvest plan. This could change, however, with improved access, which would enhance the economics of harvests in the area. If the Bradfield road were developed primarily as a resources road, and markets for Southeast timber continue to improve, some harvest could occur in the area. If the road is constructed as a public use highway, viewshed becomes more of a concern. Further, greater emphasis on recreation-related management is more likely, and logging perhaps less likely.

The 1997 Tongass Land Management Plan designates the forested area on the U.S. side of the proposed Bradfield Road as Timber Production, land use designation TM. The goal of this designation is to maintain and promote industrial wood production from suitable timber lands, providing a continuous supply of wood to meet society's needs. Areas in the Timber Production land use designation (LUD) are characterized as suitable timber lands managed for the production of sawtimber and other wood products on an even-flow, long-term sustained yield basis.

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<sup>70</sup> Office of Trade and Economic Analysis (OTEA), Trade Development, International Trade Administration, U.S. Department of Commerce 2002 export data.

For purposes of this cost benefit analysis, it is assumed that improved access would stimulate a harvest of 5 mmbf annually from the valley for five years, resulting in 25 mmbf total harvest. It is further assumed that this timber would be processed by Southeast mills and would generate a gross value of \$300 per thousand, resulting in a total economic value for Southeast Alaska of \$1.5 million annually for the five-year harvest years.

### **Shipment of product out of Southeast Alaska on the Bradfield Road**

Ketchikan and Wrangell mill operators would be most likely to utilize a Bradfield/Iskut road to move product to market, though interest appears limited at this time.

Pacific Log and Lumber in Ketchikan distributes lumber from its Seattle yard. Since the majority of freight movement in Southeast waters is northbound, barge companies offer significant cost reductions to producers moving freight southbound. Pacific Log and Lumber can transport lumber from Ketchikan to Seattle for \$50 per thousand board feet (mbf). Company executives stated that it would be unlikely they would move lumber by road given the much higher cost of road transportation.

Silver Bay Logging Company in Wrangell also distributes lumber from its Seattle yard. SBL produces a mixture of dimensional lumber, shop grade lumber, cants, and other products as requested by customers. The company expects to employ about 60 people to process about 35 million board feet of lumber this season.<sup>71</sup> Transportation of timber from Silver Bay's operation is expected to be handled by outside contractors moving the product by barge to the Seattle lumber yard. Silver Bay did not foresee a need for road transport of its product in the near future.

Sealaska Timber Corporation is also active in the Southeast timber industry. However, their existing timber stands are not near the Bradfield Canal. It is very unlikely they would use Bradfield Canal for the transport of lumber products. (Sealaska ships round logs to overseas markets, primarily). If the Forest Service were to offer sales from this part of the forest, they might consider movement over the road. Typically, though, they would seek to move their product by barge before choosing road transport.

### **BC as a source of timber for Southeast Producers**

One potential benefit from road access to the timber stands in the Iskut Valley is as feed stock for Southeast sawmills. Mills in Southeast continue to struggle with timber supply shortages. There is an effort underway to develop a more vertically integrated forest products industry in Southeast, centered around a manufacturing facility (an MDF plant, for example) that utilizes lower-grade logs. The challenge is in securing a large and predictable enough timber supply to attract the private financing necessary to build such a facility. It is possible that Tahltan harvests (which have no export restrictions) could be one component of that timber supply base.

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<sup>71</sup> "Silver Bay Logging pulls out of bankruptcy" by Christine Schmid of the Juneau Empire on January 8, 2004.

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### Fresh Product Shipment from Southeast

Cool chain management, as it is referred to in logistics transportation, is the process of moving perishable fish products to market. Weak links or breaks in the chain have a cumulative effect of reducing the potential shelf life of product. Efforts to strengthen the cool chain, such as the development of new, more efficient modes of transportation, can only have a positive effect on optimizing the shelf life, quality, and sales price of fresh product.

Fresh Southeast Alaska seafood currently moves to out-of-state markets in one of four ways:

1. Alaska Marine Lines loads refrigerated trailers on the Alaska Marine Highway ferry system headed to ports with road links (primarily Skagway and Prince Rupert).
2. Lynden transports fresh seafood on Evergreen Eagle Airlines using deficit cargo space for return flights under contract to the U.S. Postal Service. (These are Seattle-based flights.)
3. Alaska Airlines takes fresh seafood on cargo flights and passenger flights depending on space availability.
4. Charter flights are arranged by processors and sometimes catcher/processors when there is enough product to warrant a shipment.

Alaska Marine Lines moves a large portion of fresh seafood from Southeast Alaska via the AMHS. A refrigerated trailer load of fresh seafood leaving Ketchikan will arrive in Seattle approximately 36 hours later. That same trailer load leaving Juneau would arrive in Seattle in approximately 60 hours. Fresh seafood with a moderately long shelf life will probably continue to move by this method.

Deficit space on U.S. Postal Service flights and available cargo space on passenger flights are not certain. Mail and passengers take priority. Charter flights are typically dedicated to the transport of the seafood but are often expensive and depend on plane availability, weather, and other factors. Charter flights would more often move the product from a community without a large airport to a community with large aircraft capabilities (i.e. a charter flight from Metlakatla to Ketchikan).

Movement of fresh seafood by the various transportation modes is summarized in the following table. These estimates are based on executive interviews with the transport providers. Because very little data was available on the movement of fresh seafood by charter plane, this category has been omitted from the table.

**Table V-1**  
**Average Out-of-State Fresh Seafood Transport**  
**by Month for all Modes of Transportation, 2002**  
**(in Pounds)**

Month	Ferry (1)	Passenger Planes (2)	Deficit Mail (3)
January	29,500	553,000	
February	43,382	410,800	
March	203,029	916,000	
April	314,068	1,311,400	
May	678,500	1,880,000	
June	980,441	2,638,000	21,750
July	2,762,588	2,385,000	36,250
August	1,318,824	2,275,000	36,250
September	1,089,765	1,358,000	29,000
October	242,941	963,000	21,750
November	38,176	711,000	
December	41,647	347,000	
<b>Total</b>	<b>7,742,882</b>	<b>15,800,000</b>	<b>145,000</b>

(1) Alaska Marine Lines (2) Alaska Airlines (3) Evergreen Eagle Airlines.

Ferry shipment of fresh seafood is best accomplished with species with a fairly long shelf life. Because halibut, salmon, and cod all have shelf lives of approximately 10 to 12 days, shipment via Alaska Marine Highway System with Alaska Marine Lines is feasible. The following table shows the average annual percent of seafood shipment by transportation mode. This information was obtained from interviews with the primary transshipment agents. Again, charter planes are not included.

Overland shipping of fresh seafood has proven economical in other regions of Alaska. For example, 42 million pounds of fresh fish are produced in the Southcentral region of Alaska. About half of that volume is shipped out of state via truck on the Alaska Highway.<sup>72</sup>

**Table V-2**  
**Annual Percent Seafood Shipment by Species**

Species	Ferry	Passenger Planes	Deficit Mail
Salmon	50%	100%	60%
Halibut	15%		15%
Cod	3%		
Crab	30%		10%
Shrimp			10%
Geoducks			5%
Sea Urchins	2%		
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

<sup>72</sup> *A Fresh Fish Distribution Center: An Assessment of Need*. Prepared for the World Trade Center Alaska by the McDowell Group, October 2001.

Ferry shipment of fresh seafood via the Alaska Marine Highway System can also only occur for species with a fairly long shelf life. The Wrangell to Bellingham trip is a twice weekly service in winter and three to four times a week in summer and takes approximately 50 hours. The Wrangell to Prince Rupert schedule takes 13 to 14 hours and is typically the preferred route to get fresh seafood to the road transportation system and then on to market. AMHS is in the process of updating its ferries to fast vehicle ferries (FVFs). Under the existing regulations for FVFs, companies may not send cargo vans unaccompanied (a tractor and driver are required). AMHS will make arrangements with companies doing regular bookings and allow the tractor and van without driver to ship via the ferry, with very stiff penalties imposed if the driver fails to meet the van at the destination port.

Halibut, salmon, sablefish, and cod all have shelf lives of approximately 10 to 12 days, so shipment via Alaska Marine Highway System or with Alaska Marine Lines is feasible.

The following table summarizes the average shelf life of fresh seafood product.

**Table V-3**  
**Average Shelf Life for Selected Southeast Alaska**  
**Fresh Seafood**

Seafood Product	Average Shelf Life
Salmon	10 - 12 days
Salmon (Roe)	2 - 3 days
Sablefish	14 days
Halibut	14 days
Cod	10 - 12 days
Crab	Sent Live
Shrimp	Sent Live
Herring Roe	4 - 5 days
Geoducks	3 days

*Source:* Dr. Chuck Crapo - Fishery Industrial Technology Center (FITC) and Julie Decker - Southeast Alaska Regional Dive Fisheries Association (SARDFA).

## Fresh Seafood Demand

Fresh fish demands a higher price, thus the incentive is strong to sell as much of the product fresh as possible. Previous McDowell Group research indicates, for example, that processors' average margin on fresh halibut was (as of 2000) about \$0.60 per pound, gross weight. In comparison, the average margin on frozen halibut was about \$0.44. The differential between fresh and frozen has likely increased since then as more halibut has moved into the fresh market. Similarly, processors' margin on fresh King salmon was \$0.90 a pound, compared to \$0.46 per pound for frozen.<sup>73</sup>

A recent study completed by the McDowell Group for the Marine Advisory Program at the University of Alaska found that processors in Wrangell and other Southeast communities would significantly increase their supply of fresh seafood moving to

<sup>73</sup> *Glacier Bay Compensation Plan Economic Assessment*, prepared for the National Park Service by the McDowell Group, August 2000.

market if better air transportation were available.<sup>74</sup> Though not as timely as air service, trucking offers the opportunity to move much larger volumes at significantly lower cost: \$0.15 cents a pound for trucking compared to over \$0.30 a pound for air freight. Trucking also compares favorably with marine shipment. Road access from Wrangell via the Bradfield road to seafood markets in Washington state is estimated at 22 hours (plus layover). This compares to the AML barge trip of six days and the AMHS ferry service of a little more than two days. A road allows transportation companies to ship daily while the barge and ferry service have limited weekly service. Given that fresh seafood has limited shelf life and that product delivery to seafood processors is variable, a road with daily transportation possibilities increases the likelihood of higher-value fresh seafood moving to market.

McDowell Group conducted telephone interviews with processors operating in the Wrangell area to determine the volume of fresh seafood that could be transported via the Bradfield/Iskut Road. Wrangell companies currently process 1.275 million pounds of fresh seafood and indicated that with a road, they would process an additional 1.55 million pounds. If this 2.825 million pounds of fresh seafood were processed and moved over the Bradfield/Iskut Road, 100 cargo vans would be required annually to transport the product.

Wrangell processors suggested that some fishing vessels currently delivering product to Petersburg would deliver to Wrangell if a road were available. In addition, fresh seafood product is currently sent via AMHS to Prince Rupert from many Southeast communities. This product could be delivered to Wrangell instead for connection to the road system. For example, Petersburg processors currently transport more than 4 million pounds of fresh seafood annually.<sup>75</sup> Some of this would likely divert to the Bradfield road. Similarly, fresh fish from other Southeast communities could also be shipped via Bradfield, as permitted by ferry schedules and costs. Ketchikan processors would use the corridor after development of the road from Ketchikan to Bradfield.

## **Benefits to the Seafood Industry**

With improved access to fresh fish markets, processors could demand higher prices for their product. These higher prices at the wholesale level could also mean higher prices for fishermen. It is not possible within the scope of this study to predict precisely which fresh fish products would move over the Bradfield, in what volumes and at what values. It is reasonable, however, to assume that a portion of the region's current fresh fish production would divert to the Bradfield and, further, that the region's total fresh fish production would increase with improved access to markets.

For purposes of the Bradfield/Iskut road benefit/cost analysis, it is assumed that Southeast Alaska's total production of fresh fish would increase by 25 percent as a result of better access to markets. It is further assumed that after completion of the Bradfield road, approximately 20 percent of Southeast Alaska's fresh fish production

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<sup>74</sup> *Freight Consolidation Study* prepared by the McDowell Group, Inc. for the Marine Advisory Program at the University of Alaska, August 2003.

<sup>75</sup> *Petersburg Fresh Seafood Freight Consolidation Facility: Analysis and Action Plan* prepared for the Petersburg Economic Development Council by the McDowell Group, Inc. December 2003.

would be transported on the road, increasing to 25 percent when Ketchikan Access is completed. Based on these estimates, approximately 6 million pounds of fresh fish would move over the highway initially, increasing to about 8 million pounds after Ketchikan Access is in place. Following that, it is assumed that the volume of fresh seafood moved through the corridor would increase at a rate of 3 percent annually (reflecting greater penetration of fresh fish markets over time). These are very broad estimates that are intended to convey the order-of-magnitude of the economic benefits of the road for the seafood industry.

Movement of fresh fish would create truck traffic on the Bradfield/Iskut road. Cargo vans typically hold an average of 29,500 pounds of product. If packaging represented 10 percent of this amount, a typical cargo van could carry 26,500 pounds of fresh seafood. Therefore shipment of 6 million pounds of fish would indicate total traffic of 225 trucks. Assuming each truck makes a round-trip, total highway truck traffic (related to shipment of fresh fish), would be about one truck a day over the year (1.25 AADT), though peak season traffic would be higher.<sup>76</sup> This would increase (to 1.6 AADT) after the Ketchikan Access road is complete (and would increase at 3 percent annually through the study period).

The value of the increase in production of fresh fish includes two components: the cost savings associated with shipping via a lower-cost transportation mode (compared to air), and value added to fish that is sold fresh rather than frozen. Shipping costs savings would be on the order of 15 to 20 cents per pound. The value-added as a result of sale as a fresh product rather than frozen is in the area of \$0.50 a pound (at the wholesale level). In this analysis a per pound dollar benefit associated with utilization of the Bradfield/Iskut road of 30 cents per pound is assumed. That translates into an annual net economic benefit of \$1.8 million in 2011, increasing to \$2.4 million after Ketchikan Access is in place in 2016. Increasing at 3 percent annually, this economic benefit would grow to \$3.4 million by 2034.

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<sup>76</sup> Calculated as 225 truck loads times 2 (to account for the return) divided by 365.

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## ***VI. PASSENGER VEHICLE TRAFFIC AND RELATED BENEFITS***

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Passenger vehicle traffic for the proposed Bradfield/Iskut transportation corridor consists of two main components: diverted existing traffic (current travelers that would be diverted to the road system from other modes of transportation, i.e., ferry or air) and induced traffic (both BC and Alaskan residents who are not currently traveling but would if a road were available). Induced travelers are most likely to use the road for tourism or recreational activities.

### **Diverted Alaska Marine Highway System Traffic**

The Alaska Marine Highway System (AMHS) provides critical transportation to Southeast's coastal communities. In 2002, the AMHS carried 263,000 passengers and 74,000 vehicles to and through Southeast Alaska. AMHS traffic has declined in recent years, from a peak of about 370,000 passengers and 97,000 vehicles, in the early 1990s.<sup>77</sup>

In Southeast Alaska, the AMHS connects with the continental road system in four ports: Bellingham and Prince Rupert at the southern end of the system, and Haines and Skagway at the northern end of the Southeast Alaska system. (A terminal in the Bradfield Canal would provide another connection, mid-region.)

On an annual basis, approximately 57 percent of AMHS travelers are non-Alaskan.<sup>78</sup> During the summer, 72 percent of travelers are non-resident while in the winter 27 percent are non-resident.

Vehicle traffic on the Alaska Marine Highway System has declined for Petersburg, Wrangell, and Ketchikan while Juneau has experienced an increase from 1992 levels. Petersburg, Wrangell, and Ketchikan have all experienced declines in population in recent years while Juneau increased by more than 2,000 residents.

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<sup>77</sup> A significant share of the decline is attributable to the transfer of Hollis service from the AMHS to the IFA. Hollis traffic included about 40,000 passengers and 10,000 vehicles annually.

<sup>78</sup> *AMHS Marketing and Pricing Study*, prepared by the McDowell Group for the AMHS, 2001.

**Table VI-1**  
**Vehicle Traffic on the AMHS, Selected Communities (1998 – 2002)**

Embarking vehicles					
	Petersburg	Wrangell	Ketchikan	Prince Rupert	Bellingham
1998	2,535	1,684	14,032	5,387	5,253
1999	2,677	1,709	15,009	6,311	4,570
2000	2,532	1,598	13,326	6,121	4,409
2001	2,421	1,766	12,621	5,517	5,202
2002	2,528	1,825	9,593	5,478	5,559
Disembarking vehicles					
1998	2,401	1,844	13,567	5,626	4,576
1999	2,543	1,868	14,188	6,418	4,023
2000	2,493	1,755	12,728	6,125	3,571
2001	2,467	1,934	11,903	5,377	4,623
2002	2,521	2,006	9,184	5,417	4,849

Source: Alaska Marine Highway System Annual Traffic Report, various years.

Passenger traffic trends generally follow vehicle traffic trends.

**Table VI-2**  
**Passenger Traffic on the AMHS, Selected Communities (1998 – 2002)**

Embarking vehicles					
	Petersburg	Wrangell	Ketchikan	Prince Rupert	Bellingham
1998	10,856	7,364	49,386	17,488	17,415
1999	12,109	8,222	54,421	20,321	14,924
2000	11,020	7,514	49,410	19,400	14,385
2001	10,839	7,200	45,059	16,732	16,638
2002	10,800	7,984	34,992	16,467	17,109
Disembarking vehicles					
1998	11,069	7,612	47,908	17,584	15,048
1999	12,401	8,218	52,476	19,579	12,824
2000	11,020	7,475	47,813	19,285	11,859
2001	10,708	7,215	43,099	16,309	14,618
2002	11,117	7,755	32,664	15,783	14,353

Source: Alaska Marine Highway System Annual Traffic Report, various years.

For highway traffic analysis, traffic is usually described in terms of daily traffic, either annual average daily traffic (AADT) or summer average daily traffic (SADT). These ADT measures are counts of total vehicle traffic, in both directions.

Ferry traffic embarking and disembarking in Prince Rupert is a source of potential traffic on a Bradfield road. In 2002, a total of 32,250 passengers either embarked or disembarked in Prince Rupert (a very small number – about 70 – of these passengers



were traveling to or from Bellingham). Assuming average vehicle occupancy of 2.3 persons per vehicle, this translates into a traffic equivalent of about 38 AADT. Similarly, the 31,462 passengers embarking or disembarking in Bellingham translates into traffic of about 37 AADT.

How much of this AMHS traffic would be diverted to a Bradfield road would depend on a number of factors, the most important being travel time and cost. On the AMHS, a trip from Bellingham to Wrangell costs approximately \$973 for a standard size passenger vehicle (\$535) and two adult passengers (\$219 each). The ferry trip involves about 46 hours of total travel time (including the two-hour early arrival at the terminal, plus an hour in Ketchikan). In addition to these costs, a stateroom for trip between Bellingham would add another \$214, bringing the total cost to \$1,187.<sup>79</sup>

On the proposed Bradfield road, a trip between Wrangell and Bellingham is a driving distance of approximately 1,148 miles (1,848 km), including the 35 mile drive from Wrangell to the Fools Inlet terminal.<sup>80</sup> Based on an average speed of 50 miles per hour (89 km/hr), the trip would require a total drive time of about 23 hours. At an average vehicle cost of \$0.47 per mile, vehicle operating costs would total \$523 for the trip.<sup>81</sup> Though the drive could be accomplished with one overnight, two nights is more likely. Adding the cost of two nights lodging brings the total trip cost to US\$693, assuming lodging costs of \$85 a night. Finally, the cost and time associated with ferrying between Bradfield and Wrangell must be considered. If we assume ferry costs similar to the Ketchikan/Metlakatla shuttle ferry, the cost for two adults and one passenger car would total \$74.<sup>82</sup> This would bring total costs associated with travel via Bradfield to \$767.

Travel times between Wrangell and Bellingham via Prince Rupert are also relevant to this analysis. The ferry trip between Wrangell and Prince Rupert takes about 12 hours (including the stop in Ketchikan) and costs \$301 for a standard vehicle and two adult passengers.<sup>83</sup> The drive from Prince Rupert to Seattle is 985 miles (1,586 km), or about 20 hours drive time. At US\$0.47 per mile, the cost of the drive would be US\$463. Two nights lodging would add another US\$170. Total cost, then, from Wrangell to Bellingham via Prince Rupert would be US\$934.

Based on this travel cost analysis, it is likely that some of the existing Wrangell/Bellingham ferry traffic would divert to a Bradfield road. Ferry travel between Petersburg and Bellingham, as well as between other Southeast communities and Bellingham (and other destinations to the south) could be similarly diverted. The tendency to divert to the Bradfield route might differ between residents and non-residents. For non-residents the ferry experience is likely part of the appeal of the trip. Residents would likely be more practical in their trip-planning, and more influenced by travel time and cost savings.

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<sup>79</sup> Based on two berth outside cabin with complete facilities.

<sup>80</sup> This includes travel from Bellingham through Vancouver (52 miles, 84 km), Vancouver to Kitwanga (783 miles, 1,261 km), Kitwanga to Bob Quinn (192 miles, 309 km) and Bob Quinn to Bradfield (86 miles, 138 km)

<sup>81</sup> From *User Benefit Analysis for Highways*, American Association of State highway and Transportation Officials, August 2003. Includes operating and ownership costs.

<sup>82</sup> Adult fare is \$21, vehicle fare is \$32, between Ketchikan and Metlakatla.

<sup>83</sup>

AMHS traffic to and from Bellingham and Prince Rupert, excluding that originating in or destined to Ketchikan, totaled approximately 39,550 passengers in 2002, the equivalent of 47 AADT. (Ketchikan travelers would be expected to continue traveling south through Prince Rupert or directly to Bellingham, because of the shorter travel times and costs. When the highway link between Ketchikan and Bradfield is completed, the economics of travel could change, depending on the cost and frequency of ferry service between Ketchikan and Prince Rupert.)

Not all of the 47 AADT would divert to the Bradfield. As indicated above, non-resident visitors might be inclined to use the ferry even if it is more expensive. Residents and non-residents alike might be reluctant to travel via the Bradfield/Iskut road because of the lack of services in the corridor, or because of winter weather concerns. For purposes of this study, it is assumed that about one-third of the existing ferry traffic would divert to the Bradfield, or approximately 15 AADT in 2011.

By 2016, when Ketchikan Access is completed, it is assumed that the Bradfield would capture one-third of the total Bellingham and Prince Rupert ferry market, including those traveling to and from Ketchikan. This would place Bradfield traffic at 25 AADT.

Ferry traffic to and from Southeast Alaska has not grown in recent years. Nevertheless, the volume of diverted traffic would be expected to increase as services and facilities are developed along the Bradfield/Iskut corridor. To account for this, it is assumed that traffic will increase at an annual rate of 5 percent for the first five years following completion of the road, then 2 percent for the remainder of the 30-year study period.

The frequency and cost of ferry service to Bradfield is a critical factor in the degree to which ferry traffic diverts to the Bradfield.

Change in travel time is another important consideration in assessing the benefits of transportation infrastructure development. Travel time analysis is complex when ferry links are included, especially when the ferry service is relatively infrequent or occurs at inconvenient hours. The clear advantage of a road is that it allows travelers to travel at the time and pace most convenient to them.

## **Diverted Airline Traffic**

Airline is the mode by which the vast majority of residents and non-residents travel to and from Southeast Alaska (excluding cruise ship passenger travel). The following table provides total airline passenger traffic to several Southeast communities for the years 1998 through 2003. This data includes departures to all destinations (northbound and southbound) and arrivals from all points of origin.

Alaska Airlines service to Wrangell includes one northbound and one southbound flight daily. The cost of a party of two to fly to Seattle is US\$680 (\$340 per person, advance purchase fare) for the three-hour flight (including a stop in Ketchikan).

With respect to Bradfield, the question is whether a road link would divert some of this air traffic. Most business travel would not divert to a highway, though some

diversion of leisure travel could be expected. Overall, very little diversion would be expected because of the time-sensitive nature of most air travel.

**Table VI-3**  
**Air Passenger Traffic in Selected Southeast Alaska Communities**  
**(1998 – 2003)**

Passenger Enplanements			
	Petersburg	Wrangell	Ketchikan
1998	16,312	9,941	101,383
1999	17,256	10,499	102,907
2000	18,439	10,367	105,982
2001	17,831	10,791	102,053
2002	17,302	9,942	100,682
2003	17,906	9,989	102,859
Passenger Deplanements			
1998	16,013	9,883	101,809
1999	16,866	10,433	102,616
2000	18,376	10,306	106,442
2001	17,832	10,834	103,372
2002	17,087	10,173	100,824
2003	17,575	10,434	104,567

Source: Juneau International Airport manager's office, Ketchikan airport manager's office, and Alaska Airlines local offices in Petersburg and Wrangell.

It is assumed that initially 20 percent of Wrangell air traffic and 10 percent of Petersburg air traffic will divert to the Bradfield. This would place diverted air traffic on the Bradfield at approximately 10 AADT. With completion of Ketchikan Access, it is assumed that 10 percent of that air traffic would divert, generating traffic of 25 AADT.

As amenities are developed along the Bradfield/Iskut corridor, additional diversion of air traffic could be expected. For purposes of this analysis, it is assumed that traffic from this source will increase a rate of 5 percent a year for the first five years, then at 2 percent annually for the remainder of the 30-year study period.

## Regional Highway Traffic Diversion

### Cassiar and Alaska Highway Travelers

A Bradfield/Iskut road is certain to attract highway travelers from the existing Cassiar Highway market, although it is difficult to predict to what extent.

Very little current information is available on the number of visitors to the Cassiar region. In 1996 (the latest available data), 593,000 visitors traveled to or through Northwest BC (this includes all non-BC residents that visited the area).<sup>84</sup> Another 1.6 million BC residents visited the area. These figures include both day and overnight

<sup>84</sup> BC Visitor Study, Report on Travel in British Columbia, Tourism British Columbia, 1998.

visitors. The Northwest region includes the area from Highway 16 north and includes Prince George and Prince Rupert.

Among non-BC residents, 237,000 visitors to Northwestern BC were from the US. Approximately 279,000 were from elsewhere in Canada and 77,000 were from overseas. Most *non-resident* visitors (81 percent) were traveling for leisure and 86 percent of *residents* were traveling for leisure.

The percentage of these visitors that traveled along the Cassiar Highway is unknown. However, 29 percent of non-residents visited the Kitimat Stikine sub-region, and 13 percent of BC residents. It appears as though a relatively small percentage of these travelers visited the Cassiar Highway region. Provincial park visitation data provides an indication of traffic to the area. In 2000, The Meziadin Lake Park received 31,000 day-use visitors and 12,000 campground visitors. The park is located at the junction of the Cassiar Highway (Highway 37) and the Stewart Highway (Highway 37A). To the north, Kinaskan Lake Provincial Park hosted 16,700 day-visitors and 8,500 campground users. Kinaskan Lake is located about 60 miles north of Bob Quinn on the Cassiar Highway. Finally, Boya Lake Provincial Park hosted 7,900 day-use visitors and 7,500 campground users. All park visitation occurs from May through September.

Highway traffic counts for the Cassiar do not provide a clear measure of visitor traffic because the counters are near populated areas and therefore include a significant volume of local traffic. Cassiar Highway summer (July and August only) traffic at the Meziadin Junction (Route 37A to Stewart) in 2001 averaged 650 vehicles per day (a measure of summer average daily traffic), with an AADT of about 190 vehicles. Traffic 2 km north of Dease Lake junction was 860 SADT in 1999 (with an AADT of 250). Traffic 0.1 km north of Cassiar Junction, was 420 SADT in 2001 (with an AADT of 130 vehicles).<sup>85</sup>

Earlier research indicates that approximately 10 percent of both resident and non-resident visitors that travel to Northwest BC region travel along some portion of the Cassiar Highway. This suggests visitation in 1996 would have been about 220,000. That visitation translates into a traffic equivalent of about 200 AADT. Park visitation data suggests that visitor travel may be lower. Total visitation of 43,000 at Meziadin Lake suggests visitor traffic volume of about 40 AADT.

For purposes of this analysis it is assumed that visitor traffic on the Cassiar is approximately 120 AADT. The portion of this traffic that might divert to the Bradfield Road is, of course, uncertain. Travelers might drive only a portion of the highway for sightseeing purposes or they might travel the Bradfield/Iskut road to catch a ferry and continue their travels either north or south on the ferry. A road into Southeast Alaska from the Cassiar could have appeal to the northwestern BC highway traveler market. It will provide visitors an opportunity to access Alaska without the commitment of an additional week or more to cross into Alaska in Skagway, Haines or on the Alcan.

A critical factor in this analysis is the frequency of ferry service to and from the Bradfield terminal. Relatively frequent service (daily, during the summer, for example) would induce more travel than would less frequent service. This is especially a concern given the lack of services available at the terminal.

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<sup>85</sup> BC Ministry of Transportation.

It is assumed that, initially, 20 percent of the Cassiar Highway market would travel on the Bradfield/Iskut corridor. This would place diverted highway traffic at 25 AADT on 2011. The same growth rates as for ferry and air traffic diversion (5 percent for the first five years, then 2 percent thereafter) are assumed for this market. Following completion of the road between Ketchikan and Bradfield, it is assumed that 30 percent of Cassiar traffic would divert to the Bradfield.

## Summary of Diverted Traffic

The following table summarizes diverted ferry, air and highway traffic. This analysis suggests that traffic would total about 50 AADT immediately after the Bradfield/Iskut road is completed in 2011, increasing to 110 AADT by 2016, and 155 AADT by 2034.

**Table VI-4**  
**Traffic Diverted to the Bradfield/Iskut Road, by Mode**  
**(including Ketchikan Access)**

	2011	2016	2034
Diverted Ferry	15	30	40
Diverted Air	10	40	55
Diverted Cassiar Highway	25	40	60
<b>Total</b>	<b>50</b>	<b>110</b>	<b>155</b>

## Small Cruise and Package Visitor-Related Traffic

The cruise ship industry has two very distinct components, the large ship industry and the small ship industry. The large ship industry is not a potential user of a Bradfield road or dock, for several reasons. Large ships require a high degree of infrastructure in the ports they visit, in terms of tours, retail opportunities, and marine services. Port selection is also based on the amount of on-board revenue that can be generated – for example, one large ship calling in Juneau can generate in the neighborhood of \$150,000 to \$250,000 from tour sales alone. A potential Bradfield development cannot hope to achieve the level of infrastructure and revenue potential required by large cruise ships.

Small ships tend to be less focused on shore excursion revenues, and often visit smaller, less developed destinations such as Petersburg, Metlakatla, and remote bays and coves throughout the region. However, based on interviews with representatives from small ship cruise lines, the potential for small ships calling at a Bradfield dock is very limited. While they have few of the same requirements as large ships, small ships still require a certain degree of infrastructure in a port they visit. Cruise passengers would require transportation, tours, and local residents to fill these roles.

If a small ship were to call at a Bradfield dock, it would have to be drawn by an exceptional tour such as bear watching. As an example, Hyder will draw one small cruise ship line in 2004 with its bear watching opportunities. Over the course of the summer, Hyder will see a maximum of only 400 total passengers, with total revenues of less than \$6,000 for the tour operator. Such a business opportunity is not

lucrative enough to draw entrepreneurs to undeveloped area such as Bradfield. As an established community, Hyder represents a much different context for tour development from Bradfield.

Because of small ships' (albeit limited) infrastructure requirements, as well as the scarce opportunity to earn revenue from the sporadic calls that a Bradfield dock could expect, small cruise ships should not be considered a potential economic contributor in case of a potential Bradfield road/dock.

## **Induced Traffic**

Induced traffic is new travel to or through an area. It represents travel that would not occur in the absence of the transportation infrastructure improvement.

### **Recreation/Leisure Travel Markets**

The scenic nature of the Bradfield/Iskut corridor, along with activities such as hunting, fishing, hiking, driving for pleasure, wildlife viewing, and camping, will generate significant traffic. In fact, this recreation/leisure-related travel is likely to be the largest (in terms of vehicle traffic) source of traffic on the highway.

This recreation/leisure market includes residents of southern and central Southeast Alaska and residents of Northwestern BC. This area has a population of approximately 45,000 residents, 25,000 in central and southern Southeast Alaska and 20,000 in northwest BC. (This analysis does not include the traditional tourist market. The Bradfield/Iskut road would not draw new non-resident tourists to Alaska or BC. Rather, the road would divert some of the existing market, as described previously.)

There are two distinct phases in the development of this market. Initially, the market will likely be relatively small. However, with completion of the Ketchikan highway link, the Bradfield/Iskut road will provide a highway/ferry loop itinerary that includes Prince Rupert, Ketchikan, Bradfield, and Highways 37 and 16, a network of roads that will draw more visitors than the Bradfield alone.

The travel habits of this region's 45,000 residents are not known, nor is their interest in travel on the Bradfield/Iskut road itself, or in the loop itinerary described above. Household survey research beyond the scope of this study would be required to compile this kind of data. However, survey research conducted elsewhere can provide an indication about the frequency of recreational travel on the proposed highway. For example, the Juneau Access Household Survey found that Juneau residents would make an average of four trips per year to Haines and Skagway, on a new East Lynn Canal Highway. This traffic would be predominantly recreation/leisure-related. Visiting the communities of Haines and Skagway (communities with well-developed visitor infrastructure, attractions and events), a 2-hour drive from Juneau, was the primary reason for the expected travel, as well as access to the continental highway system. The Bradfield/Iskut road would not have the same potential to draw traffic, as the only significant community linkages would be five to six hours drive between Wrangell and Prince Rupert (plus the time associated with ferry travel).



For purposes of this analysis it is assumed that prior to the development of highway access to Ketchikan, that households in the region might make a trip on the Bradfield/Iskut road at a rate of one trip every other year. These trips, it is assumed, would be round-trip, that is, up the highway, then back, on the Bradfield/Iskut. With development of Ketchikan Access, travel frequency would increase to one round-trip per year per household, and one one-way trip per year per household (the Bradfield-Prince Rupert loop, for example).

Based on these assumptions, traffic from local households would account for about 15,000 annual trips after development of the corridor, then up to 50,000 trips annually after the Ketchikan highway to Bradfield is completed. These estimates translate into 40 AADT and 135 AADT, respectively.

**Table VI-5  
Regional Resident Induced Recreational/Leisure Travel  
on the Bradfield/Iskut Road**

	Total Resident Population	Number of Households	One-way trips/year	Round-trips/year	Total Highway Trips	Initial AADT
<b>2011: Bradfield/Iskut Only</b>	45,000	15,000	0	0.5	15,000	40
<b>2016: Bradfield/Iskut and Ketchikan Access</b>	50,000*	16,600	1	1	50,000	135

\*Increase in population from 2011 to 2016 based on annual growth rate of 2%.

Of course, these estimates represent averages. Some households would travel more frequently, some less. Ferry service frequency and cost are important factors in the volume of induced recreational/leisure travel on the new road. Frequent and affordable ferry service will encourage travel, to a point.

Recreational/leisure travel would be expected to increase at about the same rate as population growth. As described earlier, the population of much of the study area has been declining in recent years. For purposes of this study, it is assumed that the population of the region holds steady at current levels until 2011, then grows at an annual rate of 2 percent for the duration of the study period.

Based on these assumptions, diverted and induced traffic on the Bradfield/Iskut road would total 90 AADT initially, increasing to 245 AADT following construction of the Ketchikan/Bradfield road, and to 345 AADT by 2034. Without Ketchikan Access, Bradfield traffic would be lower, at 110 AADT in 2016, and 155 AADT in 2031.

**Table VI-6**  
**Diverted and Induced Bradfield/Iskut Road Traffic**

	2011	2016	2034
<b>With Ketchikan Access</b>			
Diverted Traffic	50	110	155
Induced Traffic	40	135	190
<b>Total</b>	<b>90</b>	<b>245</b>	<b>345</b>
<b>Without Ketchikan Access</b>			
Diverted Traffic	50	65	90
Induced Traffic	40	45	65
<b>Total</b>	<b>90</b>	<b>110</b>	<b>155</b>

## Economic Benefits of Resident and Visitor Traffic

The economic benefits associated with recreational/leisure travel includes spending in the communities along the corridor. Spending on gas, lodging, groceries, gifts/souvenirs, and other goods and services can create jobs and income in the affected communities.

Very little data is available on the spending habits of resident travel in either Alaska or BC. A 1995 study conducted for the BC government found that non-resident BC visitors spent an average of C\$54 per day or C\$234 per trip while in the Northwest region of BC. BC residents spent an average of C\$54 per day but spent slightly less time in the region and therefore spent an average of C\$178 for the trip. Non-residents spent an average of 4.4 days in region. BC residents spent an average of 3.4 days in region.

Survey research in Alaska indicates that independent non-resident highway travelers spend an average of \$80 per day during their Alaska visit.<sup>86</sup> Residents would be expected to spend at a somewhat lower rate. For this study it is assumed that spending associated with travel on the Bradfield/Iskut road will generate spending of \$40 per day per person. It is further assumed that the average trip will be 1.5 days (to reflect the fact that some traffic will be strictly pass-through, while others will take more time and spend more money in the area).

Based on these assumptions, total economic activity in the Bradfield/Iskut and Highway 37 areas would be approximately \$2.2 million in 2011, \$6.1 million in 2016, and \$8.7 million annually in 2034. These estimates assume Ketchikan Access is in place by 2016. In the absence of Ketchikan Access, Bradfield-related spending would total \$2.3 million in 2011, \$2.7 million in 2016, and \$4 million annually in 2034.

This money will be spent in BC and Southeast Alaska, mostly in the larger population centers of Prince Rupert and Ketchikan, but also in the many smaller communities in the Highways 37, 37A and 16 areas of BC. It is important to note that not all of this would be new money to the region. Spending by diverted traffic may have spent in the same region, though in different locations. Similarly, some the induced traffic may include spending that would have otherwise occurred in the local or regional economy.

<sup>86</sup> *Alaska Travelers Survey*, McDowell Group, Inc., 2003.



## ***VII. FREIGHT TRANSPORTATION-RELATED BENEFITS***

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Development of the Bradfield/Iskut transportation corridor could have important implications for the movement of freight into and out of Southeast Alaska (in addition to the fresh fish movement described above).

Routine movement of freight into and out of British Columbia and the Yukon would not be affected by the Bradfield/Iskut corridor. Prince Rupert and Stewart provide efficient transshipment opportunities for serving the freight needs of coastal and interior BC communities. Highway 37 and Highway 16 communities are served primarily by truck from Vancouver or via marine transport and truck from Prince Rupert.

Skagway would continue to serve as the primary barge/truck transshipment point for products moving north or south. There would be no cost advantages to extending the length of the trucking leg and reducing the marine leg (which would be the case if freight were barged to Bradfield then trucked to the Yukon).

The following analysis focuses on the freight-related impacts of the Bradfield/Iskut corridor on Southeast Alaska.

### **Regional Freight Volumes**

Southeast Alaska is now supplied primarily by barge, with movement of time-sensitive goods by air. The AMHS also provides van service. Seattle serves as the primary point of origin and destination.

#### **Barge Service**

Ketchikan receives barge service from Seattle three times weekly, twice weekly by Alaska Marine Lines and weekly by Northland Services, Inc. Wrangell receives twice weekly service; once a week by AML and once a week by Northland.

Based on Corps of Engineers data, 596,000 short tons of freight moved through the Ketchikan harbor in 2001 (the most recent available data).<sup>87</sup> Freight movement included 367,000 tons of fuel and related products. Approximately 44,000 tons of various wood products moved through the harbor and 14,000 tons of fish products.

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<sup>87</sup> Waterborne Commerce of the United States for Calendar Year 2001, Department of the Army Corps of Engineers.

**Table VII-1**  
**Summary of Freight Traffic in Select Southeast Communities**  
(in thousands of short tons of freight, in-bound and outbound combined, 2001)

	Ketchikan	Wrangell	Petersburg
Petroleum Products	367	9	20
Wood Products	44	3	2
Fish Products	14	2	25
Groceries/Beverages	16	4	12
Equipment/Vehicles	89	5	22
Other	66	1	12
Total	596	24	93

Source: US Army Corps of Engineers.

Fuel is the single largest commodity (in terms of tonnage) shipped to Wrangell, at 9,000 tons in 2001. Wood products, fish and groceries are also important. Petersburg sees significantly more freight movement, due largely to its commercial fishing and seafood processing industries. The large local fleet has high fuel needs, and local processors produce millions of pounds of fish for shipment out of the region.

### AMHS Van Service

The AMHS carried 3,616 vans in 2002, 3.9 percent of AMHS traffic in terms of number of vehicles and 6.3 percent in terms of car deck space. Barge lines often use the AMHS as a supplement to their service, where direct barge service is not available. Assuming the average van carries 20,000 pounds of cargo, the AMHS in total hauled about 36,000 tons of cargo in 2002, representing a small percentage of total freight movements in Southeast Alaska.

**Table VII-2**  
**AMHS Van Traffic between Selected Origin/Destination Pairs, 2002**

City	(ON)	(OFF)				
		Petersburg	Ketchikan	Wrangell	Prince Rupert	Bellingham
Petersburg	60	-	6	2	18	20
Ketchikan	370	2	-	107	39	14
Wrangell	129	1	5	-	110	11
Prince Rupert	271	5	63	64	-	0
Bellingham	177	0	36	0	0	-

Source: AMHS.

### Air Freight

Approximately 3 million pounds of air freight moved in or out of Wrangell in 2002, according to Bureau of Transportation Statistics data. Another million pounds of mail were shipped to or from Wrangell via air freight. Ketchikan air freight volume totaled just over 10 million pounds, along with 7 million pounds of air mail.

**Table VII-3**  
**Air Freight Volumes to and From Wrangell and Ketchikan, 2001**  
 (pounds, excluding regional air taxi)

	Freight	Mail
<b>Wrangell</b>		
Origin	1,636,927	423,216
Destination	1,344,068	632,936
<b>Ketchikan</b>		
Origin	5,429,031	3,436,451
Destination	4,980,857	4,018,272

Source: Bureau of Transportation Statistics

## Shipping Cost Analysis

### Current Service Costs

**Barge service:** The cost of barge service is based on the type and value of the commodity being shipped and can vary significantly. Barge lines offer negotiated rates for regular large scale customers.

On average, the cost of barging a 20-foot dry container from Seattle to Ketchikan is about \$500, and about double that for a 40-foot container (actual costs depend on weight). The cost to barge a freezer/refrigerated van is about double the amount for a dry container.

The cost of barging a 20-foot dry container from Seattle to Wrangell is about \$600, and about double that for a 40-foot container.

**Ferry service:** The cost to move a 21-foot van from Wrangell to Prince Rupert is \$221 (including a \$20 unaccompanied vehicle fee), and \$740 to Bellingham (\$50 unaccompanied vehicle fee). A standard 28-foot van costs \$338 and \$1,140 from Wrangell to Prince Rupert and Bellingham, respectively.

The cost to move a 21-foot container on the AMHS from Ketchikan to Prince Rupert is \$138 (including a \$10 unaccompanied vehicle fee) and \$667 to Bellingham (\$50 unaccompanied vehicle fee). A standard 28-foot van costs \$207 and \$1,026 from Ketchikan to Prince Rupert and Bellingham, respectively.

**Air Freight:** The following air cargo cost data is based on published Alaska Airlines air cargo rates. For larger volumes, negotiated rates may be available.

**Table VII-4**  
**Air Cargo Costs from Wrangell/Ketchikan**  
**to Various Destinations, per 2,000 lbs**

	Seattle	Vancouver	Denver	Los Angeles
<b>General Cargo</b>				
Economy	\$1,020	\$1,300	\$1,500	\$1,240
Priority	1,380	2,080	2,400	1,980
<b>Seafood</b>	640	920	920	920

Source: Based on published Alaska Airlines data, compiled by McDowell Group.

## Bradfield Freight Analysis

Movement of a cargo van between Wrangell and a central location on the continental highway system would include ferry costs, plus the cost to truck to the location. Kitwanga, BC, represents such a central point. Via Prince Rupert the cost would total approximately \$563 (including \$338 for the ferry and \$225 for the 150-mile drive to Kitwanga), for the standard 28-foot van.

Trucking between Wrangell and Kitwanga, B.C., via Bradfield would include the 35-mile highway link between Wrangell and the Fools Inlet ferry terminal, the ferry link between Fools Inlet and the Bradfield terminal, and the 271-mile highway link between Bradfield and Kitwanga. Based on a trucking cost of approximately \$1.50 per mile, for a 20,000 pound load, the highway portions of the trip would cost about \$460. The ferry link is assumed to cost \$95, bringing the trip total to \$555.<sup>88</sup>

When Ketchikan Access is completed, shippers will choose between trucking via Bradfield and ferrying to Prince Rupert, for access to the continental highway system. Via Bradfield, costs would include the 77-mile drive to Bradfield (including the Behm Canal ferry crossing) and the 271-mile drive to Kitwanga. The total cost is estimated at \$572 (including \$522 in trucking costs, at \$1.50 per mile, and \$50 in ferry costs). From Ketchikan to Kitwanga via Prince Rupert, the cost would include \$207 for the 28-foot van on the ferry, and \$225 for the 150-mile drive to Kitwanga, for a total of \$432. Therefore, access to a central location on the continental highway system will remain less expensive through Prince Rupert.

A similar analysis can be done comparing trucking via Bradfield with barge service to Seattle. Total trucking distance between Seattle and Wrangell via Bradfield is 1,133 miles (1,824 km) with a cost of \$1,700. Including the cost of the ferry link between Bradfield and Fools Inlet (\$95) and the drive between Fools Inlet and Wrangell (35 miles, for a cost of \$53), the total cost of this route is \$1,848. Barging that same 20,000 pound van or container (with an equivalent weight of cargo) to Seattle would have a cost of about \$600.

Similarly, trucking from Ketchikan via Bradfield (once Ketchikan Access is completed), a 1,210-mile trip would cost more than barging directly to Seattle, nearly by a factor of three (\$1,865 versus \$500).<sup>89</sup>

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<sup>88</sup> Ferry cost is based on Metlakatla to Ketchikan vehicle cost of \$75, plus \$20 for the driver.

<sup>89</sup> Trucking costs of \$1,815 plus Behm Canal ferry charges of \$50.

**Table VII-5**  
**Freight Cost Analysis, Various Modes, Wrangell/Ketchikan**  
**to Kitwanga and Seattle (20-foot Van)**

Route/Mode	Total Cost
<b>Access to Continental Highway System</b>	
Wrangell to Kitwanga via Bradfield	\$563
Wrangell to Kitwanga via Prince Rupert	\$555
Ketchikan to Kitwanga via Bradfield	\$572
Ketchikan to Kitwanga via Prince Rupert	\$432
<b>Access to Seattle</b>	
Wrangell to Seattle via Bradfield	\$1,848
Wrangell to Seattle via Barge	\$600
Ketchikan to Seattle via Bradfield	\$1,865
Ketchikan to Seattle via Barge	\$500

While trucking via Bradfield does not generally compare favorably with barge service for the movement of most cargo, trucking does compare favorably with airfreight costs. This suggests that Bradfield would be used for the movement of high-value, time-sensitive goods.

As described in a preceding chapter, there is unmet demand for fresh seafood produced in Southeast Alaska. With more affordable, yet still timely transport options, a much larger volume of fresh product would be shipped out of the region (generating greater income for local processors and fishermen).

As indicated above, air freight costs range from 32 cents a pound to \$1.20 a pound depending on the product, the weight, and urgency of the delivery. With trucking costs of 1.50 per mile, 20,000 pounds of fresh fish destined for Denver, for example (a 2,184-mile drive from Wrangell via Bradfield), would cost \$4,200 (including ferry charges). By air the cost would total \$9,200. Air freight would be more expedient, requiring one or two days, while trucking would require three to four days. However, for product with a 10 to 12 day shelf life, the cost savings would likely outweigh the loss of a day or two of shelf life. Similarly, trucking 20,000 pounds of fish to Seattle would cost approximately \$1,850 compared to \$6,400 for air service. Trucking would require approximately two days.

Air freight has an advantage over trucking in that smaller shipments – a few thousand pounds – are possible. Such small shipments would not be possible via truck without consolidation with other shippers. Nevertheless, it is clear that highway access for seafood processors will provide an affordable and practicable alternative to air freight. Further, shipment of fish out of Southeast could create low-cost back-haul opportunities.

Other shippers of time-sensitive goods could also benefit from highway access. As an example of this potential, a significant portion of the groceries sold in Fairbanks are trucked into the state. In the past, grocery stores in Haines have been supplied by truck from Lower 48 sources.

## Summary

Analyzing the impact of construction of the Bradfield/Iskut corridor, or any multi-model transportation network, on freight movement, is complex. Many factors come into play, namely:

- the weight and density of cargo
- back-haul opportunities (which can significantly reduce costs)
- the overall volume of cargo to be moved for any single customer or group of customers requiring the same basic service (large-volume customers with consistent scheduling needs can draw lower prices)
- Ferry service costs, service frequency and weight or scheduling limitations that might affect commercial shippers
- Fuel costs
- The time sensitivity of the cargo
- Origin/destination of the cargo.

It is difficult to predict with any degree of certainty how the business world would respond to construction of the Bradfield/Iskut corridor. The Bradfield/Iskut corridor would not replace barge service as the primary avenue for transporting most general cargo into and out of Wrangell. The most likely near-term response will be utilization of the corridor for the movement of time-sensitive goods, such as fish (outbound) and perishable groceries (inbound). Over the longer-term, however, highway access would give businesses and consumers the opportunity and versatility to choose a shipping mode that best meets their specific needs.

Shippers north of Wrangell (in Petersburg, Sitka and Juneau, for example), may also choose to use the Bradfield to move time sensitive goods. However, the cost to do so increases significantly with each ferry link. For example, under SATP, a Sitka shipper must take the ferry to Petersburg, drive to the South Mitkof terminal, ferry to Wrangell, drive to Fools Inlet, then ferry to Bradfield, before finally reaching the continental highway system. The cost and inherent scheduling delays associated with three ferry links is very likely to eliminate economic advantages compared to barge, mainline ferry service to Prince Rupert, or air freight.

The Juneau Access project, if developed, would provide the region with another highway link to the continental highway system. Trucking from Juneau to Seattle, except for time-sensitive goods, would not be competitive with barge service. The cost to truck from Juneau to Seattle, a distance of 1,715 miles, would be approximately \$2,575, while barging the same 20,000 pound load would cost about \$1,100. Another alternative for Juneau shippers might be to ship to Bradfield via AMHS, then south to Seattle by highway. This would include a Juneau/Petersburg ferry link, a Petersburg/South Mitkof highway link, a South Mitkof to Wrangell ferry link, a Wrangell to Fools Inlet highway link, the Fools Inlet to Bradfield ferry link, and finally the 1,133 mile highway link between Bradfield and Seattle. The cost of this alternative would total approximately \$2,300 including \$1,800 for the highway time and \$500 for the ferry links and related fees. This suggests that movement of goods south from Juneau through Bradfield might be slightly more cost-efficient than trucking north on the proposed Lynn Canal highway. Neither option, however, is competitive with barge service.

It should be noted that a critical factor in determining the volume of freight trucked via Bradfield is the cost and convenience of ferry service. Affordable, regular service will support development of freight traffic along the corridor.

Development of new supply centers other than Seattle is also a potential result of improved highway access for southern Southeast Alaska. For example, overland shipment of goods from Midwest supply centers could be competitive with shipment through Seattle, especially if the supplies moving through Seattle originate in the Midwest.

### **Freight Traffic Estimates**

For purposes of traffic forecasting and benefit/cost analysis, it is assumed that Bradfield freight traffic would be equivalent to about 25 percent of current barge traffic to Wrangell. Further, it is assumed that the Bradfield would attract about 50 percent of the Wrangell freight traffic that uses the AMHS for access to Prince Rupert or Bellingham. Finally, it assumed that the Bradfield would capture approximately 20 percent of Wrangell freight that is now carried by air.

Based on these assumptions, the Bradfield road would carry about 10,000 tons of freight (not including the fresh fish described in a previous chapter). It is further assumed that freight to and from other Southeast communities would add another 5,000 tons of freight annually, for a total of about 15,000 tons. This would roughly translate into 1,500 truck loads, with average annual daily traffic of four trucks. There would be some seasonal variation, with truck traffic peaking in the summer. These freight traffic estimates do not include any traffic that might be generated by resource development in the Iskut or Highway 37 corridors.

To place this volume in perspective, truck traffic on the Alcan at the Alaska/Yukon border was 38 AADT in 2002. Truck traffic at the Haines Highway border crossing in 2002 was 1,625 vehicles, an AADT of just over four trucks. Skagway border crossing truck traffic in 2002 was 3,446 trucks (including a significant number of fuel trucks), an AADT of nine trucks.

If the Ketchikan Access project (the road linking Ketchikan and Bradfield) is completed, freight traffic on the Bradfield would increase. If Bradfield were to capture 5 percent of Ketchikan's current barge traffic, 50 percent of the current ferry van traffic to Ketchikan and 10 percent of the current air freight volume, the total freight volume on the Bradfield would be approximately 40,000 tons, or the equivalent of about 4,000 truck loads. This equates to an AADT of 11 trucks.

Truck traffic would be expected to increase over time, to the extent that local economies grow. The southern Southeast economy has been in decline over the past several years. However, for purposes of this study it is assumed that economic growth will average about 1.5 percent per year for the 30-year study period. At that rate of growth, truck traffic (excluding that associated with Ketchikan) would increase to 6 AADT by the end of the study period (2034). With Ketchikan Access, total truck traffic on the Bradfield in 2016 would be 12 AADT and 15 AADT by 2034.

It is important to note that the extent to which Bradfield becomes a widely used link to the continental highway system for all of Southeast Alaska (not just central and southern Southeast) will depend to a large degree on the affordability and frequency of intra-region ferry service.

The monetary value of shipping larger volumes of time-sensitive goods and other materials is difficult to measure, and depends on the types and volumes of materials being shipped, its origin and destination and numerous other factors. Still, order of magnitude estimates are possible. If it is assumed that the monetary benefit is overall equal to about five cents per pound, the total annual benefit associated with trucking via the Bradfield (rather than using some other form of transportation) would initially be equal to approximately \$1.5 million. This measure of benefit represents several factors, including the potential for truck access to lower-cost sources of goods, higher revenue for sellers of time sensitive goods (both import and export), and savings in freight costs, particularly for goods that would otherwise move by air.

This annual benefit would increase over time as traffic increases. By 2034, when an estimated 50,000 to 60,000 tons of freight is moved, the annual benefit would total over \$5 million (this assumes the Ketchikan Access project is completed in 2016).

**Table VII-6**  
**Freight-Related Traffic and Economic Benefits**

	2011	2016	2034
Traffic (AADT)	4	12	15
Tons of Freight	15,000	40,000	55,000
Economic Benefit	\$1,500,000	\$4,300,000	\$5,600,000



## **VIII. HYDROELECTRIC POWER-RELATED BENEFITS**

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The Bradfield/Iskut road may generate cost savings to hydroelectric and interconnection developers in the Iskut and Southeast Alaska areas, as well to potential mining developments that could be supplied by hydro rather than on-site diesel generation.

### **Forrest Kerr Hydro Project**

Coast Mountain Hydro (CMH) is building a 100 MW run-of-river (i.e., no storage) power plant on the Iskut River immediately downstream of its confluence with Forest Kerr Creek. This site is upstream of the larger proposed BC Hydro Iskut hydroelectric project investigated in the 1970's and 1980's. The project requires construction of a 6-mile (9-km) access road from the existing Eskay Creek road near Volcano Creek. Coast Mountain's Forest Kerr Hydroelectric Project has received approval from the BC Environmental Assessment office and the Canadian Environmental Assessment Office.<sup>90</sup>

The Forest Kerr Hydroelectric Project will have 112 MW of installed capacity. In addition to the access road, the project requires construction of a 3.2 km long 20' by 26' high (6 by 8 meter high) tunnel, which will be the penstock. Water will be diverted through the penstock to be delivered to four vertical turbines and then re-enter the Iskut River below the Iskut gorge. A 3-meter weir will be built across the Iskut River forming a small head pond to collect water during low flow periods. The interconnection to BC Hydro will be an AC-DC-AC back-to-back transmission system to ensure reliability and will allow bi-directional power flow.<sup>91</sup> This will provide the added flexibility of accessing BC Hydro power, when CMH can only generate 10-12 MW during the low-flow winter period, to supply firm power to potential mining projects.

The total planned investment is \$C195 million, including C\$36 million for the tunnels. CMH has a sales contract to deliver 138 kV power to BC Hydro at Meziadin 110 miles south on Highway 37. Power will be delivered from the powerhouse to Highway 37 underground along Eskay Creek road. At Highway 37 the power will be transmitted via an above ground conductor to Meziadin, which is the closest point of connection with the BC Hydro system. The interconnection will cost C\$18 million plus C\$48 million for the AC-DC-AC back-to-back transmission system.<sup>92</sup>

Coast Mountain Hydro has sold 80 percent of its output to BC Hydro. BC Hydro has agreed to purchase 540 GWh of electricity per year (about 62 MW) over 15 years at a price of about C\$0.055/KWh with the delivery of power to commence no later than 2006.<sup>93</sup> The cost of the transmission line along Highway 37 to the site is estimated C\$24 million. Coast Mountain will begin construction in 2004.

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<sup>90</sup> BC Environmental Assessment Office [www.eao.gov.bc.ca/epic/output/documents/](http://www.eao.gov.bc.ca/epic/output/documents/)

<sup>91</sup> Coast Mountain Hydro Corp. (2003) Forrest Kerr Project Certificate (E03-01) Quarterly Report – Condition (6). Sept. 12, 2003.

<sup>92</sup> Pers. Comm. Cliff Grandison, Coast Mountain Hydro. Jan. 19, 2003.

<sup>93</sup> Coast Mountain Hydro Corp. [www.coastmountainhydro.ca](http://www.coastmountainhydro.ca)

To operate at full generating capacity a total of 134 m<sup>3</sup>/sec of water needs to be diverted to the turbines. The Iskut River's average annual discharge is about 275 m<sup>3</sup>/sec with annual low flows of about 30 m<sup>3</sup>/sec during January, February and March and high flows during run-off period in July in excess of 1,500 m<sup>3</sup>/sec. This run-of-river flow regime means that during the late fall, winter and early spring, the plant would operate below capacity and power output will be about 11 MW. The company had plans for a minimum release below the intake weir of 5 m<sup>3</sup>/sec to the diversion reach in the lower canyon, about 3.2 km in length between the weir and the tailrace. Following the Canadian Environmental Assessment Act review, the minimum rate was increased to 5 percent of mean minimum flow, 16m<sup>3</sup>/sec. This reduces power production during the winter months.

## **Alaska Interconnection**

The Four Dam Pool consists of Thomas Bay Power of Wrangell and Petersburg, Ketchikan Public Utility, and more distant utilities Kodiak Power and Copper Valley Power, Valdez. The Thomas Bay Power Authority is being interconnected with Ketchikan Public Utilities in 2004.

### **Thomas Bay Power Authority**

Thomas Bay Power Authority is a municipal power utility, which operates the 25 MW, state-owned Tyee hydroelectric power plant serving Wrangell and Petersburg. The Tyee power plant is located near the head of the Bradfield Canal. Thomas Bay Power Authority's winter load is about 10 MW, which declines in spring to about 7 MW. The power utility operates the reservoir levels in Tyee Lake to maintain a one-year water reserve and does not normally need to spill water. The reservoir level is at 1,300 feet, with a penstock drop of about 600 feet.

### **Ketchikan Public Utilities**

Electricity in the Ketchikan area is generated by hydroelectric power facilities owned by the State of Alaska and the City of Ketchikan. The Alaska Energy Authority owns the Swan Lake, Terror Lake, and Solomon Gulch hydro facilities. The Ketchikan Public Utility owns the Beaver Falls, Silvis Lake, and Ketchikan Lake facilities, with a combined capacity of 8 MW.<sup>94</sup> The Swan Lake facility operates near its capacity to generate an average of 9 MW. Ketchikan Public Utility has an agreement with the Alaska Energy Authority not to displace Swan Lake power. KPU also owns about 15 MW of diesel generation capacity to meet intermittent needs in excess of hydro generation capacity.

### **Tyee Ketchikan Interconnection**

The Thomas Bay Power Authority is being interconnected with Ketchikan Public Utilities' 9 MW Swan Lake hydroelectric power plant near Ketchikan in 2004.<sup>95</sup> The Swan Lake Tyee transmission interconnection with Ketchikan Public Utilities system is 58 miles in length at an estimated cost of \$83 million. During certain times of the

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<sup>94</sup> HDR Alaska Inc. "Gravina Access Project" Oct. 2000 [www.gravina-access.com/project\\_reports/docs/Affected/%20Environment.pdf](http://www.gravina-access.com/project_reports/docs/Affected/%20Environment.pdf)

<sup>95</sup> Alaska Community & Economic Development [www.legaudit.state.ak.us/pages/audits/2000/pdf/4588rpt.pdf](http://www.legaudit.state.ak.us/pages/audits/2000/pdf/4588rpt.pdf)

year, the Swan Lake generating facility does not have enough capacity to supply Ketchikan's load, which requires higher-cost thermal peaking capacity to be brought on-line. With the interconnection, the two systems will have the flexibility to more efficiently use its lower cost hydro and displace higher cost thermal power.

Demand and cost difference can provide benefits from enlarging the generating and load base through interconnecting power systems. Power production in the Four Dam Pool is priced at \$0.028/KWh, plus a debt service charge set at \$0.04/KWh for a total price of \$0.068/KWh. The actual cost of producing power at the Tyee generating station is less than \$0.01/KWh. The price of electricity from Ketchikan Public Utility is \$0.076 per KWh plus a monthly customer service charge of \$50 and a demand charge of \$2.65 per KWh of maximum demand in excess of 25 KW.<sup>96</sup> There are additional surcharges if the cost of diesel fuel or power purchases from Swan Lake exceeds budgeted costs.

The Ketchikan Public Utility is short of hydropower; however, with the interconnection with the Tyee generating station, the utility hopes to sell shore-based power to the cruise ships at a price of \$0.05/KWh. The ships use between 6 to 11 MW of power while they are tied up in the Ketchikan port. The interconnection will also allow the utility to displace thermal generation, thus reducing its average costs.

With the Tyee-Swan Lake intertie, Wrangell, Petersburg and Ketchikan will be interconnected. Ketchikan will have the right to purchase surplus power (after Wrangell and Petersburg's needs are met) from Tyee. Additional surplus could eventually be sold to Kake, when that intertie is completed, perhaps by 2007. The Tyee surplus (after Wrangell, Petersburg, Ketchikan and Kake are supplied) is projected to be exhausted by about 2022. Development of hydroelectric projects at Whitman Lake, Conel Lake and Mahoney Lake in the Ketchikan area could add to the region's total generating capacity, as could a Metlakatla/Ketchikan interconnection. Metlakatla currently has surplus hydroelectric generation capacity.<sup>97</sup>

### **Alaska Power Costs**

The City of Saxman has proposed to construct and operate a 5 MW average capacity hydroelectric project at Mahoney Lake near Ketchikan. The project would be sited on private land claimed by the Cape Fox Corporation under the Alaska Native Claims Settlement Act and on approximately 114 acres of National Forest land in the Tongass National Forest. The power from this proposed project was initially priced at \$0.065 per KWh <sup>98</sup> but was reduced in the final bid to \$0.05 per KWh in order to compete with the Tyee intertie project. Ketchikan Public Utility is also investigating new 4 MW project at Whatman Lake.

Metlakatla Power & Light, the electric utility for the town of Metlakatla, 15 miles south of Ketchikan, has excess generating capacity. Their Purple Lake hydro power plant has a capacity of 3.9 MW. The utility estimated it would cost \$4 million to interconnect and quoted a price of \$0.065/KWh for their electricity provided that

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<sup>96</sup> City of Ketchikan Municipal Code [www.city.ketchikan.ak.us/pub/municode/code11-08.pdf](http://www.city.ketchikan.ak.us/pub/municode/code11-08.pdf)

<sup>97</sup> *Southeast Alaska Intertie Study*, Phase 2, Draft Report. Southeast Conference, September 2003.

<sup>98</sup> City of Ketchikan, Minutes of Special Council Meeting, June 13, 2000

[www.city.ketchikan.ak.us/d1/citycl/minutes/m000314](http://www.city.ketchikan.ak.us/d1/citycl/minutes/m000314)

Ketchikan Public Utility builds the power line. Their average industrial price of power is \$0.091/KWh. These high power costs suggest that Canadian power could be supplied at less cost than some of these alternatives.

It appears that the Four Dam Pool could not offer power to buyers in Canada for significantly less than the price to Alaska buyers, \$0.068 per KWh. Coast Mountain Hydro is receiving less than that for their power sales to BC Hydro, so it would be unlikely they would be willing to purchase power from Alaska. The possibility may exist for Alaska to purchase power at lower cost from Coast Mountain Hydro or consider other system economies to the benefit of both parties.

## **Alaska-BC Interconnection**

Coast Mountain Hydro has mentioned the possibility of interconnecting its Forrest Kerr project with the Thomas Bay Power Authority's Tyee power plant. The interconnection could potentially benefit both parties, and could allow Alaska to be interconnected to the North American grid and allow better utilization of transmission capacity to BC Hydro's system. The interconnection to the Tyee power plant at the head of the Bradfield Canal would be a distance of 63 miles (100 km). Given the Coast Mountain Hydro generation project is not yet constructed, no cost estimates are available for this possible interconnection.

Based on the interconnection costs between Coast Mountain Hydro's generating project and the BC Hydro terminal at Meziadin, a lower-end cost estimate would be on the order of \$20 million for an interconnection, including the underground portion in Alaska. The existence of Bradfield/Iskut road could reduce construction and maintenance costs thereby providing benefits to the interconnection project with the Tyee generating station Alaska Four dam Pool.

### **Interconnection Benefits**

The Bradfield/Iskut road corridor would reduce construction costs if an interconnection between Coast Mountain Hydro and the Thomas Bay Power Authority were to be constructed following completion of the road. The road would provide easier access, reduce the costs of staging equipment and hauling in power poles and conductors, and reduce the need for building construction roads and using airlifts.

If the existence of the Bradfield-Iskut road could reduce construction costs by perhaps 30 percent, it would result in an expected benefit of \$4.6 million. This assumes the interconnection will be constructed after completion of the road.

### **Mining Power Benefits**

Once completed, the Coast Mountain Hydro project has the potential to supply hydropower to mining projects in the area, at a lower cost when compared to on-site diesel-electric generation. Crushing and concentrating ore (required to reduce haul costs) is power-intensive. The former Snip mine had 3.4 MW of on-site generation when it operated in the 1990's. The Eskay Creek mine is an immediate candidate, with 2.4 MW of on-site diesel generation. However, most of the potential mining developments, such as Galore Creek, Red Chris, Sulphurets-Kerr, would not involve

the Bradfield-Iskut road power corridor, with perhaps the exception of Skyline Gold's Bronson Slope project.

If Skyline Gold's Bronson Slope project were to proceed, its power requirements could be met by Coast Mountain Hydro. The delivered price from Coast Mountain Hydro or from BC Hydro would be about \$0.05 per KWh based on current market prices, excluding any transmission surcharges. It appears that the Bronson Slope project could benefit from the Bradfield/Iskut road, if it were to proceed with power supplied from Coast Mountain Hydro. Based on a transmission line cost of \$225,000/mile for a 69 kV line between Coast Mountain Hydro to Skyline, it is estimated the presence of the road could save perhaps 30 percent of construction costs, or \$1.2 million.

This is a speculative benefit assigned to the Bradfield/Iskut road, since it assumes that the Skyline Gold project proceeds, and that it will be supplied from Coast Mountain Power. The Skyline Gold project is no longer an active project, since it has been withdrawn from the environmental approval process.

There are also long-term potential benefits for the mining industry in Alaska. Though development is not imminent, prospects in the central Southeast area, such as the Woewodski Island prospect west of Wrangell, could benefit from access to a large power grid.

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## **IX. COMMUNITY COSTS AND BENEFITS**

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On the Alaska side of the border, the cities of Wrangell and Ketchikan are the nearest communities to the proposed corridor. Other Southeast communities may also be affected by road access if the road provides more economical and efficient means to get products to market, particularly communities with products such as seafood or timber. Some communities could benefit from an increase in visitor traffic, including the communities on Prince of Wales Island. In BC, Stewart and Prince Rupert are the larger communities with the highest level of interest in the Bradfield/Iskut road project. The economies of these communities, as well as the numerous small communities along the Highway 37 corridor, would be affected by the resource development and visitor traffic implications associated with the Bradfield/Iskut road. These implications are discussed below.

### **Alaska Communities**

#### **Wrangell**

Wrangell, a community of 2,100 residents, is located on the northern end of Wrangell Island, 2.5 miles from the Stikine River Delta. Access to Wrangell is via Alaska Airlines daily jet service or by the Alaska Marine Highway System. Transportation of cargo and perishable goods is available by air and three interstate marine transportation companies. Charter companies provide additional transportation needs by marine or air service.

Wrangell's economy is based on commercial fishing, timber manufacturing, tourism and government. The local economy has been in decline since 1994 when the community's largest employer, the Alaska Pulp Corporation sawmill, closed. Since 1994, Wrangell has lost one-quarter of its population (Wrangell's population peaked in 1994 at 2,750 residents). Wrangell's population as of 2003 was estimated at 2,114.<sup>99</sup>

Fishing and fish processing remain important segments of the economy. In 2002, 240 residents held commercial fishing permits and 173 Wrangell residents held crew licenses. Seafood processors and local fishermen stand to benefit from development of the Bradfield/Iskut corridor. As described elsewhere in this report, improved access to Wrangell could give local processors better access to fresh fish markets. Fresh fish markets draw higher prices than frozen fish. This could result in more income for local processors and higher prices paid to fishermen who sell their catch in Wrangell.

The timber industry in Wrangell includes Silver Bay Logging Company which operates the former APC mill. Improved access to the Iskut and Highway 37 areas could benefit Wrangell's timber industry by providing an alternative means of shipping milled wood products. It could also provide additional sources of mill feed stock, particularly from Tahltan timber harvested from the Iskut area (see timber industry impacts analysis).

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<sup>99</sup> Alaska Department of Labor and Workforce Development.

Wrangell's tourism industry includes a mix of independent visitor and cruise ship passenger traffic. Development of the Bradfield road would bring additional independent visitors to Wrangell. With improved access, a larger share of the independent market would be expected to visit Wrangell. Further, as Bradfield linkages are developed (as envisioned in the Southeast Alaska Transportation Plan), including the highway linking Bradfield and Ketchikan, and InterIsland Ferry Authority (IFA) service linking Wrangell and Prince of Wales Island, Wrangell will capture additional independent visitor traffic.

## **Ketchikan Gateway Borough**

Ketchikan is an industrial center and a major port of entry in Southeast Alaska. Ketchikan is supported by a large fishing fleet, fish processing, tourism, timber and government. Ketchikan's population has declined steadily since its single largest employer, Ketchikan Pulp Company, ceased operations in 1997. The community has lost about 1,000 residents since then and now has a total borough-wide population of 13,700.

Ketchikan relies on the Alaska Airlines for passenger and airfreight service, and Alaska Marine Highway System for passenger and vehicle transportation service. Most freight moves via barge.

Construction of the Bradfield/Iskut road alone would not be expected to have a significant impact on the economy of Ketchikan, nor would it change how goods and materials are shipped to and from the community. With construction of the Ketchikan/Bradfield road link, however, the community would have a direct link to the continental road system (with only a short shuttle ferry link in Behm Canal). The community could expect an increase in visitor traffic to the community, increased value for locally produced fish products (as more fish are sold in the higher-value fresh fish markets), and potentially some timber industry-related benefits could result (stemming from timber harvests in the Bradfield drainage).

## **Other Southeast Communities**

Other communities in Southeast Alaska might benefit from road access through Bradfield Canal. Communities on Prince of Wales Island (with a total population of about 4,000) would have improved access to the continental highway system if the Interisland Ferry Authority initiates service between Coffman Cove and Bradfield.

Other communities in central Southeast, such as Petersburg and Sitka, would benefit by somewhat improved access to the continental highway system. For these communities, the Bradfield/Iskut road could provide more efficient and economical access to product markets and to suppliers of time sensitive goods. Further, if transporting seafood to Canadian and U.S. markets via the road becomes viable, transportation companies will seek to obtain loads for the backhaul section of the trip. Since these truck trips might otherwise return empty, trucking companies may offer backhaul rates competitive with barge shipments.

It is difficult to isolate (from regional transportation infrastructure) the economic benefits accruing to Southeast communities as a result of Bradfield development. Businesses and residents of Sitka, Petersburg, Kake and other communities north of



Wrangell could benefit from improved access to the continental road system, assuming full implementation of the SATP, which includes more frequent and dependable ferry service throughout the region.

## Canadian Communities

Several Canadian communities would be affected by the proposed Bradfield/Iskut transportation corridor. These are described below. Overall, the resource development-related benefits of road construction would flow primarily to the communities of BC. The number of jobs potentially created or affected by construction of the Bradfield/Iskut road, including mining, timber and visitor industry-related employment, totals several hundred.

Mine development projects that could potentially benefit from the Bradfield/Iskut road include the Red Chris and Galore Creek projects. These are large-scale mining operations with very high labor requirements. Neither projects has advanced to the stage where employment estimates have been prepared, however.

It has been described in this study that millions of dollars of annual savings could result from access to a deepwater port via Bradfield. Clearly, there is uncertainty about specifically how and when construction of the Bradfield road will benefit nearby communities. The fact that there is very substantial potential benefits is undisputed. In the *Independent Technical Report for the Galore Creek Property*, prepared for SpectrumGold by GeoSim, Inc., of Vancouver, BC, the report's authors state "if constructed, this [the Bradfield] route would have enormous impact on the viability of any local mining operations in the area, including Galore Creek."<sup>100</sup>

## First Nations

The Bradfield-Iskut road would be situated on lands that fall in the traditional territory claimed by the Tahltan and Iskut First Nations, whose closest community is Iskut, located approximately 65 miles (104 km) north of the Eskay Creek road intersection with Highway 37, at Bob Quinn.

### Tahltan First Nations

The Tahltan First Nations people are the original settlers of the Stikine area. The Tahltan communities include Telegraph Creek, Dease Lake, and Iskut. Tahltans were traditionally a nomadic people, centered on the Stikine River, which provided the Tahltans fish and trading access with the Coast. The Tahltan are historically connected to the Tlingit from Wrangell, Alaska. Each year the Tlingit made their way up the Stikine River to dry fish and trade with the Tahltans. Tahltans were situated between the Coastal and Interior natives, which resulted in the Tahltans becoming active in trading.

Currently the main sources of employment for First Nations in the Iskut-Stikine area are government administration, construction, mining, commercial fishing and guide outfitting. Some First Nations people also spend part of the year working outside of

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<sup>100</sup> "Independent Technical Report for the Galore Creek Property". Prepared for SpectrumGold, Inc. by GeoSim Services, Inc., August 2003, pg. 39.

the area. The Tahltan Nation Development Corporation (TNDC), representing the Iskut and Tahltan First Nations and the Tahltan Tribal Council Society, employs over 50 people in road and other construction contracts. The Tahltan First Nations have been involved in the former Golden Bear Mine (to the north) and the Eskay Creek Mine.

The Tahltan First Nation was involved in the Eskay Creek road completed in 1994. The Tahltans make up about one third of Barrick Gold's Eskay Creek mine workforce.<sup>101</sup> The Tahltan Nation Development Corporation (TNDC) contracts services to the Eskay Creek mining operation. The TNDC has a C\$1.0 million annual contract to maintain a 37-mile (59 kilometer) private Eskay Creek road from Highway 37 to the gold mine. Road construction, maintenance and snow-clearing services are provided by TNDC through a Life of Mine contract.

A subsidiary of TDNC provides catering and cleaning services to the mine. Following the first three-year contract, the Tahltans formed their own catering company, Spatsizi Remote Services Corporation in 1999, which now provides the camp services. There is also a joint venture between Arrow trucking and the TNDC for ore hauling. This qualified TNDC for bonding and TNDC can now bid on government road maintenance contracts.<sup>102</sup>

## **Dease Lake, Telegraph Creek and Iskut**

### **Dease Lake**

Located on Highway 37 at the junction with the road to Telegraph Creek, the town of Dease Lake was established as a Hudson's Bay trading post in 1838. It is a regional center for some government services including health, police, Northern Lights College, and BC government offices of Highways, Parks, Forests, Social Services and Family and Children.

Dease Lake has a population of approximately 650 people. This number can fluctuate during the winter and summer months due to a high number of seasonal workers. When the Cassiar asbestos mine closed in 1992, Dease Lake assumed the role of regional center. The resulting transfer of several public offices led to an increase in population in the early 1990's; however, the population has declined since then as government services have centralized in Smithers.

Visitor activities include fishing, canoeing, kayaking, flightseeing, hiking and shopping. Visitor services include accommodations, meals, fuel, groceries and vehicle repair. Specialized services such as guide/outfitters, and rentals for boats, canoes and ATV's are available. Winter activities include cross-country skiing and snowmobiling. There are several inns, campgrounds and RV parks in the Dease lake area.

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<sup>101</sup> <http://srmwww.gov.bc.ca/ske/lrmp/cassiar/>. See also Shirley Collingridge, Sasktel "Barrick Gold Corporation and Tahtan Nation: Eskay Creek Mine" [www.shirleycollingridge.com/barrickapr2003.htm](http://www.shirleycollingridge.com/barrickapr2003.htm)

<sup>102</sup> [http://www.nrcan.gc.ca/mms/sociprac/barrick\\_e.htm](http://www.nrcan.gc.ca/mms/sociprac/barrick_e.htm)

## **Telegraph Creek**

Telegraph Creek is located beside the Stikine River, 70 miles southwest of Dease Lake, and is the traditional home of the Tahltan First Nation. Telegraph Creek is reached via a rough Forest Service road that runs from Dease Lake, passing through the Stikine River Recreation Area, near the Grand Canyon of the Stikine River, and passing through Telegraph Creek to end in Glenora, another gold rush boomtown in its heyday. The population of Telegraph Creek is about 350. The road would not directly affect the town. However some of the construction and maintenance crew could be drawn from Telegraph Creek. Tahltan Development Corp. has employees from Dease Lake, Telegraph Creek and Iskut. Telegraph Creek would also likely see an increase in the number of visitors to the community, as a result of improved access for Alaskans to the continental highway system and the many recreational opportunities along the Cassiar Highway.

Visitor activities include camping, fishing, hunting, and flightseeing. Telegraph Creek is the starting location for paddlers who are dropped off below the Stikine Grand Canyon and float downstream to Wrangell. Visitor services include fuel, groceries, meals, accommodations and guide services.

## **Iskut/Tatogga**

Iskut has a population of about 280 and is located adjacent to Highway 37, about 88 miles from the road. The majority of the population are members of the Iskut First Nation. There are 105 people in the employed labor force, and the unemployment rate is 20 percent. The village of Iskut serves as a staging area for the Spatsizi Wilderness, Mount Edziza, and Kineskan Parks. A guide outfitting operation, a general store, the Iskut Trappers Association, and the Tahltan Development Corporation provide employment in the community.

Harvesting of mushrooms occurs in the vicinity of the road project and provides an income source for Iskut residents and the region. The road area falls within registered trap line territories.

Iskut's location provides access to many parks and recreation areas including Todagin Mountain Wildlife Management Area, Spatsizi and Edziza Parks, Lake Eddontenajon, Kiniskan Lake Park and Morcheau Lake Camp ground. Visitor activities include fishing, hiking, camping, boating, canoeing, kayaking, biking, horseback riding and wildlife viewing. Visitor services include fuel, groceries, meals, camping, RV park, minor vehicle repairs and guide services. There is a full range of accommodations available in the area including several ranches, resorts and lodges.

Just south of Iskut is the small unincorporated community of Tatogga where visitors can find meals, cabins and a campground.

## **Road Impacts in the Dease Lake, Telegraph Creek and Iskut Areas**

The road falls within the traditional territory of the Iskut First Nation and more widely within the Tahltan Joint Councils.<sup>103</sup> There are jurisdictional, archaeological,

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<sup>103</sup> Coast Mountain Hydro Corp., BC Environmental Assessment Office Application, 2002 Based on Archeological study by the Bastion Group, and DM Cultural Services Ltd., Victoria, BC [www.eao.gov.bc.ca/epic/output/documents](http://www.eao.gov.bc.ca/epic/output/documents)

heritage, and other issues to be considered along the road corridor. The mushroom harvest provides a limited seasonal income source for Iskut residents and the region.

It is unlikely the road could be built without support of the Tahltan Joint Council. The Tahltan Nation Development Corporation and the community of Iskut would expect to share in the benefits from construction and maintenance of the road. The Tahltan Nation Development Corporation, which currently maintains the Eskay Creek mining road, would likely be interested in building and maintaining the road, subject to Council approval.

Dease Lake, 132 miles north of the project, would see benefits from the construction as a significant number of the road building and maintenance crews could be drawn from Dease Lake area. The office of Tahltan Development Corporation is in Dease Lake.

Positive benefits may also be generated by an increase in road traffic north of the Bradfield/Iskut road along Highway 37. The abundance of Provincial Parks and recreation opportunities in this area could attract additional visitors, which would benefit the roadside businesses along the route.

Timber harvests in the Iskut area would also provide employment and income opportunities for residents of this area.

## **Stewart and Meziadin Area**

### **Stewart**

Stewart is located across from Alaska's Misty Fjords National Park at the end of the 90-mile Portland Canal, 550 miles north of Vancouver and 113 miles north of Prince Rupert. Stewart is 40 miles west of Meziadin, BC at the end of Highway 37A. The Alaska Highway is accessible by Highway 37 joining at Watson Lake in the Yukon. Kitwanga is 147 miles to the south, located on the main east-west BC Highway 16. Terrace is the closest community by road (other than the neighbouring community of Hyder), which is 204 miles to the south. Mining development has played a prominent role in the history of Stewart.

Around WWI, Stewart's population boomed as a result of a number of mining developments, such as the Red Cliff Mine (1908 to 1912) and the Portland Canal Mine (1908 to 1911).<sup>104</sup> During this time a railroad was constructed from the Red Cliff mine to deep water on the Portland Canal. Stewart became prominent again during the 1920's following the discovery of the exceptionally high-grade Premier gold and silver mine, and others such as the Big Missouri and the Riverside mines. Through the

**Figure IX-1**  
**Hyder, AK and Stewart, BC (Right)**



<sup>104</sup> <http://www.stewartbc.com/> and BC Stats *Community Facts*

1930's and 1940's mining activity in Stewart suffered, with closing of the Big Missouri Mine in 1948 and the huge Premier Mine in the 1950's.

In the 1960's, the Granduc copper mine was developed, which included construction of an 11-mile tunnel to access the Leduc copper body, which was an exceptional engineering feat at that time. The mine also required construction of a marine bulk-loading terminal. The Granduc mine operated between 1971 and 1984. During this period Stewart's population was nearly 1,500. Following closure of the Granduc mine the population had declined to about 900 by 1986.

In recognition of this downturn, the BC government awarded three forest licences for a total of 1,000,000 m<sup>3</sup>/yr, in addition to the approval for log exports through the Port of Stewart, in recognition of low quality timber and timber access problems typical of the area. The timber licences were later sold to West Fraser Timber and Skeena Cellulose in the 1990's. These timber licences helped to stabilize the economy of Stewart and the Meziadin area.

In 1987, the former Premier gold and silver mine was reactivated and assisted in the extension of BC Hydro grid power to the community in 1989. By 1991 the population of Stewart had increased to 1,200. However, shortly afterward the Premier gold mine and Cassiar asbestos mine in northern BC both closed, and by 1996 the population of Stewart had declined to about 900. As of 2001, the population was 661.

At present, the mining and forestry industries are primarily responsible for the development of support services such as heavy-duty mechanics, welding shops, and transportation-related businesses, which provide service to all the basic resource industries. Employment in the community is now more broadly based and includes the transportation, mining, logging, retail and hospitality sector, and public administration sectors. Stewart Bulk Terminals Ltd. has a ship loader in the Port of Stewart that is used for loading concentrates onto 45,000 dwt deep-sea ships. In addition to the bulk loader, the town has a barge terminal, paved road to transportation routes, grid power, expanded municipal infrastructure and a 3,900 foot paved airstrip. Stewart has developed as an important transshipment center for resource companies (mining and timber) that operate throughout the Northwest. The community is endeavouring to promote the use of its port facilities, shipping, mining and timber products, as well as its visitor industry.

Current visitor activities include guided fishing, glacier viewing, camping, and hiking. A full range of standard visitor services are available in the community including a variety of accommodations. Taquan Air, a floatplane service out of Ketchikan, serves Stewart. The Stewart area has been used in the filming of five major Hollywood films and multiple commercials in the past few years.

Average annual earnings in 2001 were \$C43,780, slightly less than the BC average of \$C44,300. Median household income was \$C45,400. The unemployment rate was 24 percent in 2001 compared to the BC average of 8.5 percent. Most employment in Stewart is in public administration (15 percent), education (14 percent), accommodation and food services (14 percent), transportation (13 percent), forestry and logging (13 percent), mining (8 percent).

## **Meziadin Junction**

Meziadin Junction is located about 60 kilometers from Stewart at the junction of Highway 37A and 37. The Lake Meziadin Provincial Park is located less than two miles west of the community. This park is a popular summer camping, fishing and recreation area. There are services available for fuel, groceries, RV hook-ups and minor vehicle repairs. Meals are available in Meziadin but there are no accommodations. About 13 miles south of Meziadin Junction is the Vandike Camp providing services including a gas station, convenience store, and a small number of apartment style accommodations. Approximately 57 miles north of Meziadin accommodations, RV hook ups and camping are available at the Bell II Lodge. Fishing is the featured activity at the lodge in the summer and high-end helicopter skiing vacations are offered in the winter. Fuel, meals, and tire repair are available.

## **Kitsault**

Kitsault is an isolated, abandoned, mining community located on Alice Arm outside of Nisga'a lands. Kitsault was built in the 1970's for employees of an Amax of Canada magnesium mine. There were several thousand residents. After only one and a half years, the mine proved to be unprofitable and was shut down. The town was abandoned. Today, there is still a complete, but vacant town. There are modern subdivisions with paved streets and curbs, apartment buildings, a community center, a recreation center and a hospital. Some logs are loaded on ships at Kitsault for export to Japan or barged to mills to the south. There have been plans to reactivate Kitsault as a port. However, none of the mining business studied in this report would use Kitsault.

## **Road Impacts in the Stewart and Meziadin Area**

Stewart would be affected by the Bradfield/Iskut road if a deepwater port were constructed at the head of Bradfield Canal. The conclusion of this analysis, described in the mining section, is that Stewart, having a relatively low-cost port facility, could compete with Bradfield and could defend its role as a port. However, if mine developers were to find it in their financial interest to develop a bulk loading terminal at Bradfield, Stewart would lose the opportunity for some new business such as the concentrate loading business from the proposed Galore Creek mine.

Shipping Galore Creek concentrate out of Bradfield Canal would not impact Stewart's current port business. Given that Eskay Creek will be curtailing shipments by 2008 (as currently scheduled), Bradfield Canal is unlikely to be available in time to cause any potential diversion of current business from Stewart.

To the extent that construction of the Bradfield/Iskut road stimulates resource development that would not otherwise occur, residents of Stewart and local businesses could benefit from new employment and sales opportunities.

Because the Bradfield/Iskut road would generate an overall increase in traffic to and through northwest BC (as a result of improved access for Alaskans to the continental highway system), communities in the area, including Stewart and Meziadin, could expect an overall increase in visitation. Increased visitor travel will include increased spending with businesses that provide goods and services to visitors.

## **Nisga'a Lands**

On May 11, 2000, the Nisga'a land agreement came into effect, which included the transfer of nearly 1,200 square miles (1,930 square kilometers) of Crown land to the Nisga'a Nation. The Nisga'a communities, Gitwinksihlkw (Canyon City), Gitlakdamix (New Aiyansh), Lakalzap (Greenville), and Gingolx (Kincolith) are communities located in the lower Nass Valley known as the Nisga'a Lands. The Nisga'a Lisims government administers the area, which include a population of 5,500 including those living in larger urban centers.

### **Gitwinksihlkw (Canyon City)**

Gitwinksihlkw (formerly Canyon City) is a Nisga'a community located on the Nass River, west of Gitlakdamix (New Aiyansh), and had an estimated population of 212 in 2001, down from 231 in 1996. The community is 95 percent First Nations. The Band Council administers 1,618 acres (655 hectares) of reserve land. The largest employers are Tower Logging and Sim Gan Forest Corporation. Facilities in the community include a Band office, community hall, community center, kindergarten school, fire hall and new school. Access to the community was by boat prior to construction of a suspension bridge in 1968. A vehicle accessible bridge was built in 1995. There are several large totem poles in the community including four new poles raised at the site of the vehicle bridge.

### **Gitlakdamix (New Aiyansh)**

Gitlakdamix (formerly New Aiyansh) is located near the Nass River approximately 62 miles (100 kilometers) north of Terrace. The community had a population of 712 in 2001 making it the largest of the Nisga'a communities. The community is 96 percent First Nations. The Band Council administers 4,942 acres (2,000 hectares) of reserve land. The forest industry, including silviculture, logging, and log booming, is the largest employer in the community. Facilities in the community include a church, Band office, community hall, warehouse, fire hall, social services, kindergarten school, youth center, and carpenter shed. Services available include a mini-mall, co-op grocery store, post office, and gas station.

Average annual earnings were \$C35,100 in 2001 compared to \$C44,300 for all of British Columbia. Median household income was \$C41,000. The unemployment rate was 34 percent in 2001.

### **Laxgaltsap (Greenville)**

Lakalzap is located beside the lower Nass River, near the Nass Bay and south of Gitlakdamix. The community, which is a member of the Nisga'a Tribal Council, numbered 467 people in 2001. The population is 98 percent native. The Band Council administers three reserves covering 4,537 acres (1,836 hectares) of land. The community has a mini-mall with several shops that feature local artwork and crafts. Log harvesting, log sorting, silviculture, commercial fishing, and the Band Council office are the community's major employers. There is a small RV park near the community. Average annual income was \$C32,000 in 2001. Unemployment was 48 percent.



## **Gingolx (Kincolith)**

Gingolx (Kincolith) is located west of Lakalzap at the entrance to Observatory Inlet near the entrance to the Portland Canal (which leads to Stewart). Gingolx is approximately 28 km from Laxgaltsap along the recently upgraded Nisga'a highway. Currently the highway is a hard-packed gravel road which the Province of BC will be seal-coating and paving in 2004. The upgraded highway greatly increases the ability of visitors to access this community. Floatplane service is available from Prince Rupert.

With a population of 340 in 2001, the community of Gingolx is made up of members of the Nisga'a Nation and is represented by the Nisga'a Tribal Council. The most important economic activity in Kincolith is the commercial fishery. The community operates a small fish hatchery that supplies salmon stocks in the Nass River area. A number of individuals either own their own boats or are involved as deckhands in the commercial fishing industry. Gingolx has deep water and could be developed as a small port in the future. Visitor services include limited accommodations, fuel, groceries and some services. The community is actively marketing to visitors. In July the community hosts a CrabFest featuring dancing, singing and other performances.

## **Road Impacts on Nisga'a Land**

The Nisga'a people are interested in encouraging tourism to their area and have a fishing lodge and the Nisga'a Memorial Lava Bed Park, which attract about 1,600 visitors annually. Although some highway improvements would likely be necessary, the Nisga'a are interested in encouraging visitors to explore the historic sites in their area. The Bradfield/Iskut road would not directly affect most Nisga'a communities, although there could be potential benefits to the Nisga'a if the road generated more visitor traffic looping through their area as an alternative to using the southern portion of Highway 37. Marketing the area's attractions to the residents of Southeast Alaska would stimulate traffic to the area, if the Bradfield/Iskut road is constructed.

## **Highway 16 East**

The communities of Kitwanga, Hazelton, and Smithers comprise the Highway 16 East region.

### **Kitwanga**

Kitwanga is a small village located at the junction of Highway 37 and the main east-west Highway 16, interconnecting Prince Rupert to Prince George. The population was 475 in 2001 and was 97 percent First Nations. Kitwanga is the closest railhead accessing the continental rail system and to smelters in eastern BC, Canada, and the US. Visitor activities include Fort Kitwanga, fishing, hiking, museums and native cultural attractions. Visitor services include fuel, groceries, meals, minor vehicle service, RV park and campground. Kitwancool, or Gitanyow, is 15 kilometers (nine miles) north of Kitwanga. Ancient totems, carving sheds and a graveyard are visible at the site.

Average annual earnings were low at \$C15,100 in 2001, compared to the BC average of \$C44,300. Unemployment was high at 40 percent in 2001.



## **Hazelton**

Incorporated in 1956, Hazelton has a population of about 345. First established by white settlers in 1866, Hazelton was the upriver terminus, from 1886 to 1913, for a fleet of sternwheelers which plied the wild rapids of the Skeena, bringing people and supplies to the nearby mines, farms and settlements. The largest community in Northwest BC between 1890 and 1915, Hazelton was a vital center of activity for prospectors, traders, merchants, pack train operators and missionaries. By highway the Village of Hazelton is 2 miles (3 kilometers) north of the District of New Hazelton and on the north bank of the Bulkley River. The District of New Hazelton has an estimated population of 826, and is the principal commercial, administrative and retail center for the area. The area had several sawmills; however, all the mills west of Smithers are presently not operating.

The Hazeltons (Old Hazelton, New Hazelton, and South Hazelton), are within an area of several Gitksan and Wet'suwet'en communities.<sup>105</sup> The Hazelton area has been home to northwest coast native cultures at 'Ksan for over 7,000 years, with the Gitksan and Wetsuwet'en peoples always living there, where the Skeena River meets the Bulkley River. The Skeena River served as an ancient trade route, navigated by 60-foot cedar canoes traveling from the coast upriver to totem-filled villages with names like Temlaham, Gitanmax and Kispiox. Hazelton had a population of 345 and New Hazelton 750 in 2001. The economy has been dominated by the forestry industry, particularly sawmilling, for the last three decades. Wood harvested in the Skeena and adjacent Kispiox Valley provides fiber for sawmills in the area, as well as for Smithers and Terrace. The largest employers in the area are Repap's Carnaby Mill, Kispiox Forest Products, the School District, the hospital, and Kitwanga Lumber.

The Hazelton area is centrally located within the Gitksan and Wet'suweten land claims area. Hazelton-based members of the Wet'suweten First Nation are involved in wildlife inventory projects in the Skeena River and Babine River areas, and are proposing a forest mushroom research program.

Visitor activities include fishing, sightseeing and native culture. The Ksan Native Village and Museum is one of the finest native heritage sites in Canada. The nearby Hagwilget Suspension Bridge hovering over the deep gorge of Hagwilget Canyon on the Bulkley River is a favorite attraction. A full range of visitor services are available in the Hazelton area.

In 2001, average annual earnings in Hazelton were \$C56,000 and unemployment was 18 percent. In 2001, Average annual earnings in New Hazelton were \$C46,300, and unemployment was 22 percent.

## **Smithers**

Smithers is located on Highway 16, approximately halfway between Houston and Hazelton. Smithers had an estimated population of 5,414 in 2001, making it the fourth-largest community in the region. Smithers was founded in 1913 as the divisional headquarters of the Grand Trunk Pacific Railroad and later became home

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<sup>105</sup>Kitwanga, Morristown, Kitwancool, Kispiox, and Gitanmaax are some of the larger communities in the Gitksan Wet'suwet'en area.

to pioneer settlers who farmed the valley, discovered its mineral riches, and developed the forest industry that is so vital to the community today. The economic base of the Smithers area is diversified, although it is still resource-oriented. The forest industry is the leading resource sector followed by mining, agriculture and tourism. Smithers has two lumber mills and a shake and shingle mill. It is the service center for the area and a divisional point for Canadian National Railway, which is also a major employer. Smithers is home to numerous government agencies and community services including: BC Government Agent, Social Services & Housing, Ambulance, Conservation Officer, Canada Employment Centre, Mental Health Centre, Forest Service Office, Agriculture & Fisheries, Fire Department, Provincial Emergency Program, Customs Office, Smithers District Chamber of Commerce, R.C.M.P., Highways Department, and Transport Canada.

Visitor activities include museums, art galleries, canoeing, kayaking, hiking mountain biking, fishing, and golf. Winter activities include a ski resort, cross-country skiing and snowmobiling. The community is located near two Provincial parks. Smithers offers a full range of visitor services.

Average annual earnings were \$C46,500 in 2001. Median household income was \$C55,700, and unemployment was 9 percent.

### **Road Impacts on the Highway 16 East Area**

Kitwanga is likely to see an increase in concentrate and ore loading with or without the Bradfield/Iskut road. Whether concentrates are shipped through Stewart or Bradfield, shipments to North American customers would be loaded on CN rail at Kitwanga.

There would be only slight impacts on the mainly Gitsxan First Nations communities of Gitanyow, Kitsequecla, and the Hazeltons. There could some increase in visitor travel, especially to the major attractions in the Hazeltons. With effective marketing, Gitanyow could also expect additional traffic at its Totem Park, craft shops and related attractions.

Smithers is the center of BC northwest mining industry, and this role could increase with the addition of the road as a result of an overall increase in mining activity in the Iskut region.

Smithers is the first major community offering services for traffic from the Bradfield/Iskut road (for those heading to the Lower 48). It would be expected that a significant number of people in these vehicles would stay overnight in Smithers. The travel time between Ketchikan and Prince George makes Smithers a convenient stopping point. Smithers could also anticipate increased business at its ski hill, swimming pool, cultural attractions, and athletic events.

### **Highway 16 West**

The communities of Terrace, Prince Rupert, and Kitimat comprise the Highway 16 West region.

## **Terrace**

Terrace is located in the Skeena Valley at the junction of Highway 16 to Prince Rupert and Highway 37 to Kitimat. Terrace had a 2001 population of 12,109 (down from 12,783 in 1996) making it the second-largest community in the region. Although historically the forest industry was Terrace's primary employer, the community has evolved into a service center. The highest proportion of jobs is now provided by the service sector (department stores, grocery stores, hotels, etc.). Other important employers include the provincial and federal governments, the school district, the hospital, West, Northwest Community College, BC Tel, and the City of Terrace. The forestry industry is presently shut down in the area.

Terrace has a developed visitor infrastructure. Visitor activities include golf, fishing, biking, hiking, kayaking, canoeing and rock climbing. In the winter Shames Mountain offers skiing and snowshoeing. A full range of visitor services are available.

Annual average earnings were \$C46,800 in 2001. Median household income was \$C53,300. Unemployment was 14 percent in 2001.

## **Prince Rupert**

Prince Rupert is the largest community on the BC North Coast, located on the western portion of Kaien Island near the mouth of the Skeena River. It is six hours by Alaska Marine Highway ferry and forty minutes by floatplane from Ketchikan. Prince Rupert is the largest port between Vancouver and the Alaskan border and currently benefits from its position as a terminus for both the Alaskan and BC Ferries as well as for Alaskan rail-barge service. The Port of Prince Rupert is North America's closest port to Asia, and is the shortest and most efficient land-sea connection between the U.S. Midwest, Asia and world markets.

Direct access to CN Rail's high capacity northern mainline and the Trans-Canada Yellowhead Highway provide land connections to the rest of North America via the lowest grades through the Rocky Mountains to the west coast. Port facilities feed directly into the Northwest Transportation Corridor, a modern road and rail route engineered and built to carry massive volumes. CN Rail is the only railroad in North America to cross the continent both east-west and north-south. Over the past decade, Prince Rupert's port has undergone significant improvement of the general cargo area and the bulk terminals for coal (Ridley Island Coal Terminal) and grain exports.

Prince Rupert has well developed visitor infrastructure. Visitor activities include fishing, boating, kayaking, whale watching, hiking, shopping, museums, native culture and flightseeing. Prince Rupert offers a full range of visitor services.

The population of Prince Rupert in 2001 was 14,643, down from 16,714 in 1996. The community has suffered major economic declines from the closure of the pulp and sawmills and from the decline in the fishing industry. Average annual earnings were \$C44,900 in 2001, close to the BC average of \$C44,300. Median household income was \$C50,058. Unemployment was at 15 percent in 2001.

## **Kitimat**

Kitimat is a major industrial center and port located at the head of Douglas Channel about 26 miles (50 kilometers) south of Terrace. The Kitimat community is known for production of aluminum, paper, methanol and ammonia. Commodities processed in the community presently contribute 11 percent of British Columbia's Manufacturing Gross Domestic Product. The aluminum represents one-third of all provincial primary metals, and one third of British Columbia's petrochemical manufacturing happens within the Kitimat facilities. Kitimat is responsible for 5 percent of the provincial manufacturing exports, and over half of the labor force is directly employed in manufacturing and shipping.

Kitimat had a 2001 population of 10,285, making it the third-largest community in the region. Kitimat is a planned community, built in the 1950s to service Alcan's aluminum smelter. Although Alcan continues to be the number one employer, other important employers include Eurocan, Methanex, the Kitimat General Hospital, the District of Kitimat, and the School District.

Average annual earnings were \$C57,300 in 2001, compared to a BC average of \$C44,300. Median household income was \$C66,800 and unemployment was 12 percent.

### **Road Impacts on the Highway 16 West Area**

Terrace is the nearest major Canadian town to the Bradfield/Iskut road project. Terrace would likely be the center for engineering of the road and constructing some of the bridges. The surveys and some of the drawings for the Iskut road extension were completed in Terrace.

Prince Rupert could experience some decline in the volume of AMHS passenger, vehicle, and RV traffic with construction of the Bradfield/Iskut road. In 2002, of the 5,429 vehicles, and 16,354 passengers embarking on the AMHS in Prince Rupert, nearly 50 percent of both disembarked in Ketchikan. Twenty percent of vehicles and 18 percent of passengers who embarked in Prince Rupert connected directly to Haines or Skagway. Visitors who currently drive from Vancouver or Prince George to Prince Rupert and connect to the Alaska Marine Highway System may instead choose to connect with the AMHS via the Bradfield road. This could increase visitor volume and spending along the route from Kitwanga to the intersection of the Bradfield road.

Vacationing Alaska residents may choose to travel a loop route from Ketchikan or Wrangell along the Bradfield/Iskut road, to Kitwanga, Prince Rupert, and back to Ketchikan or Wrangell. Communities and businesses along this route could expect some increase in traffic volume and visitor spending. Construction of the Bradfield/Iskut road, coupled with improved ferry service between Ketchikan and Prince Rupert, could substantially increase travel through the region. The SATP recommends improvement of ferry service between Ketchikan and Prince Rupert, including construction of a new ferry, referred to as the Southern Gateway Shuttle<sup>106</sup>. The shuttle would have a capacity of 50 to 65 vehicles and 15 vans and would provide daily service between the two communities. The shuttle is proposed to

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<sup>106</sup> Southeast Alaska Transportation Plan (SATP), August 2004, pg. 56.

enter service in 2008. If a new vessel has not been constructed by then, the Matanuska could be deployed in its place.

In summary, though the Bradfield road might divert some mainline ferry traffic from Prince Rupert, implementation of Southern Gateway Shuttle service would increase overall travel to and through Prince Rupert.

Bradfield/Iskut would have no impact on other port operations in Prince Rupert. Present and future movement of containerized freight, coal and other materials would not be affected.

Terrace could expect some increase in visitors from Ketchikan. Currently a small number of Southeast Alaska residents, mostly from Ketchikan, pass through Terrace on the way to ski at Shames Mountain or Smithers.

Although several companies in Kitimat could compete for some of the bridge, concrete, paving and roadwork for the Bradfield/Iskut road, there should be no impact on the port of Kitimat. There would likely be little impact from the Bradfield/Iskut road on the number of visitors to Kitimat.

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### **Roadway Engineering**

#### **Introduction**

The conceptual design and cost estimates were prepared by the Western Federal Lands Highway Division of the Federal Highway Administration (WFLHD) for the Alaskan portion of the road study, from a deep water access near the head of Bradfield Canal to the British Columbia border. The following narrative was provided by WFLHD.

The City of Wrangell and U.S. Forest Service cooperated in the WFLHD study. Funds were secured for the conceptual engineering assessment and environmental overview phases of the Bradfield/Iskut project from High Priority Project Funds Section 1601.

WFLHD focused its study efforts on a two-lane paved roadway, designed to American Association of State Highway and Transportation Officials (AASHTO) standards for rural collectors. Several other studies have looked at other options that included single lane gravel roads, but WFLHD intends to use the rural collector design standards as a benchmark for comparisons of various alternative alignments and design standards. There are currently three different tidewater termini that are included in the study as potential deep-water ports for the proposed ferry terminal at the head of Bradfield Canal (beginning of the project), and their merits and shortcomings will be discussed in the technical narratives.

All alignments were developed at a conceptual level, based on a reconnaissance level of data collection. The data gathered for these conceptual alignments could be utilized in future design studies of this proposed transportation corridor.

#### **Design Assumptions**

The design standards shown below were derived from "A Policy on Geometric Design of Highways and Streets 2001", Fourth Edition, by the AASHTO, and from discussions with representatives of ADOT&PF, the City of Wrangell, and USFS.

- Future Average Daily Traffic (ADT) in the year 2010 will not exceed 400
- Design Speed: 35 miles per hour (MPH)
- Minimum Horizontal Clearance: 10-foot (10'0") lane, bounded by two 2-foot (2'0") shoulders
- Maximum Grade: 10%; Desirable Maximum Grade: 8%
- Pavement Design: 4 inches (4") Asphalt Surfacing; 5 inches (5") Aggregate Base; 8 inches (8") Select Borrow
- Superelevation: 6%
- Minimum Horizontal Curvature: 380 feet (380'0")

The conceptual design values were based on AASHTO highway standards for "rural major collector" highway, but do not incorporate additional widths for curve widening, guardrail, intersections and other miscellaneous widening situations.

The conceptual alignment and all analytical conclusions shown in the plan and profile sheets have been identified through orthophotography and LIDAR mapping analysis. No ground proofing was conducted, and further ground analysis will be required to verify all aspects of these conceptual designs.

### **Operational Assumptions**

The study assumes that the Bradfield River Road will be in operation year round. Potential geological hazards identified along the corridor include debris flows and snow avalanches, which could affect year-round operation and necessitate a future detailed hazard risk assessment for these factors. Therefore, conceptual design alignments and grades incorporated only a general assessment of the area.

Based on the identified hazard potential, a road maintenance facility along the Bradfield River corridor will most likely be necessary. The scoping process also identified the potential need for a staffed U.S./Canada border station. Both facilities may be required for the future operation of this transportation corridor, but are outside the scope of this study and are not included in this engineering report.

### **Methodology**

Based on topographic maps, a project corridor was developed and mapped by acquiring high-resolution LIDAR and color orthophotography of the proposed project area. GEOPAK Digital Terrain Models (TIN files) based on approximate 3-foot intervals were produced from the LIDAR data.

Utilizing the TIN files, conceptual alignments were then developed throughout the proposed corridor. WFLHD formed a Cross Functional Team (CFT) comprised of a Hydrologist, Geologist, Environmental Specialist, Bridge Engineer, and Road Designer, which conducted a preliminary aerial field review of these conceptual alignments. For design purposes, the proposed corridor was divided into five different segments. Each segment included various alignment alternatives that were field-checked by the CFT. The CFT based its recommendations on the feasibility and estimated costs of construction, environmental concerns, and geological hazards, and used these factors to conceptualize one alignment from which a quantity-based estimate could be developed. Conceptual design plans and cost estimates for the proposed alignment were presented to ADOT&PF, USFS, and the City of Wrangell for review. Feedback received from these three agencies expanded the starting termini to include two additional options and was then incorporated into Segment 1: Option A (original scoped terminus), Tyee Hydro; Option B, Duck Point; and Option C, Kapho Mountain. There is one common proposed alignment for the remaining segments (segments 2 through 5).

### **Conceptual Alignment Descriptions**

#### ***Segment 1 Option A, Tyee Hydro***

This segment begins at the west end of the existing road serving the Tyee Hydroelectric Project facility, where Tyee Creek flows into the Bradfield River. The existing road, currently under permit from the Tongass NF to the Tyee Hydroelectric Project facility, is approximately 2.5 miles in length. The road sustains minimal traffic, and appears well maintained. The conceptual alignment follows the existing road through the hydroelectric plant's housing facilities. Prior to reaching the

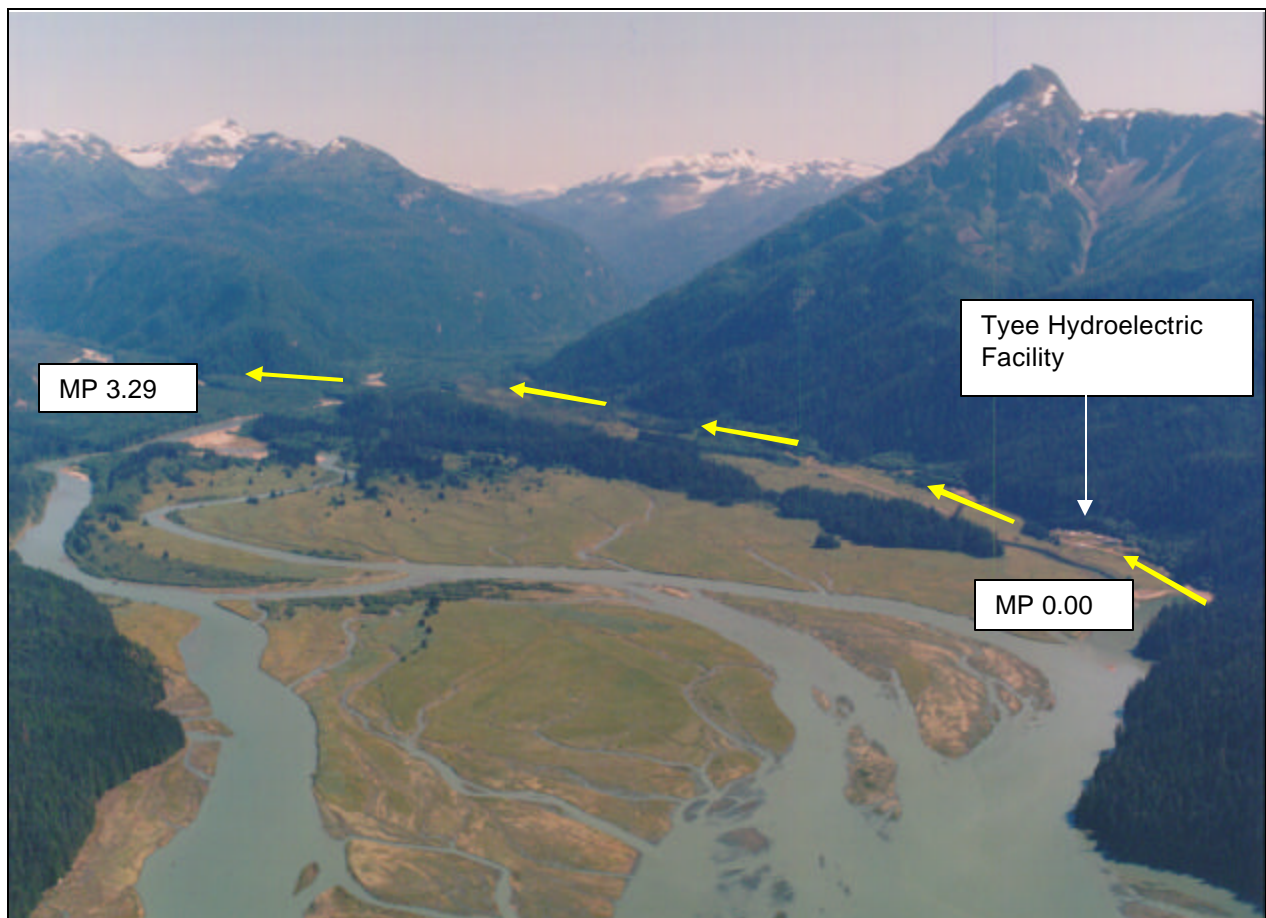


hydroelectric penstock at milepost (MP) 0.36, the conceptual alignment was shifted westerly 200 feet, and parallels the existing road for approximately 2,500 feet. This will allow hydroelectric personnel to access and maintain the penstock facility. Access to the Tyee penstock will need to be evaluated further, and included in the design and cost estimate.

At MP 0.61, the alignment crosses the discharge of the penstock and is estimated to require a bridge structure. The realignment rejoins the existing road at MP 0.80, just prior to the intersection with the Tyee aircraft landing strip. This intersection should also be included in any future final design and cost estimates for the project. The conceptual alignment continues to follow the existing road alignment to MP 2.30. Beyond this point the existing road continues easterly for approximately 1000 feet to a collapsed log stringer bridge. The log abutments are still intact, but aerial observation of this old crossing shows the location to be in the channel migration zone. For this reason, at MP 2.30 the conceptual alignment leaves the existing road and continues northward to MP 2.60, where bedrock is present on both sides of the river and the channel is more confined. At this location (MP 2.60), a crossing was identified that will require an estimated 325-foot bridge structure.

All river crossings have been identified through orthophotography and LIDAR mapping, and will require further analysis to verify this as an acceptable bridge location. From MP 2.6, the conceptual alignment then moves eastward to the base of a solid rock bluff, and follows the old logging road alignment at the base of the bluff to the terminus of this segment at MP 3.29.

**Figure X.1 Segment 1, Option A, Tyee Hydro**



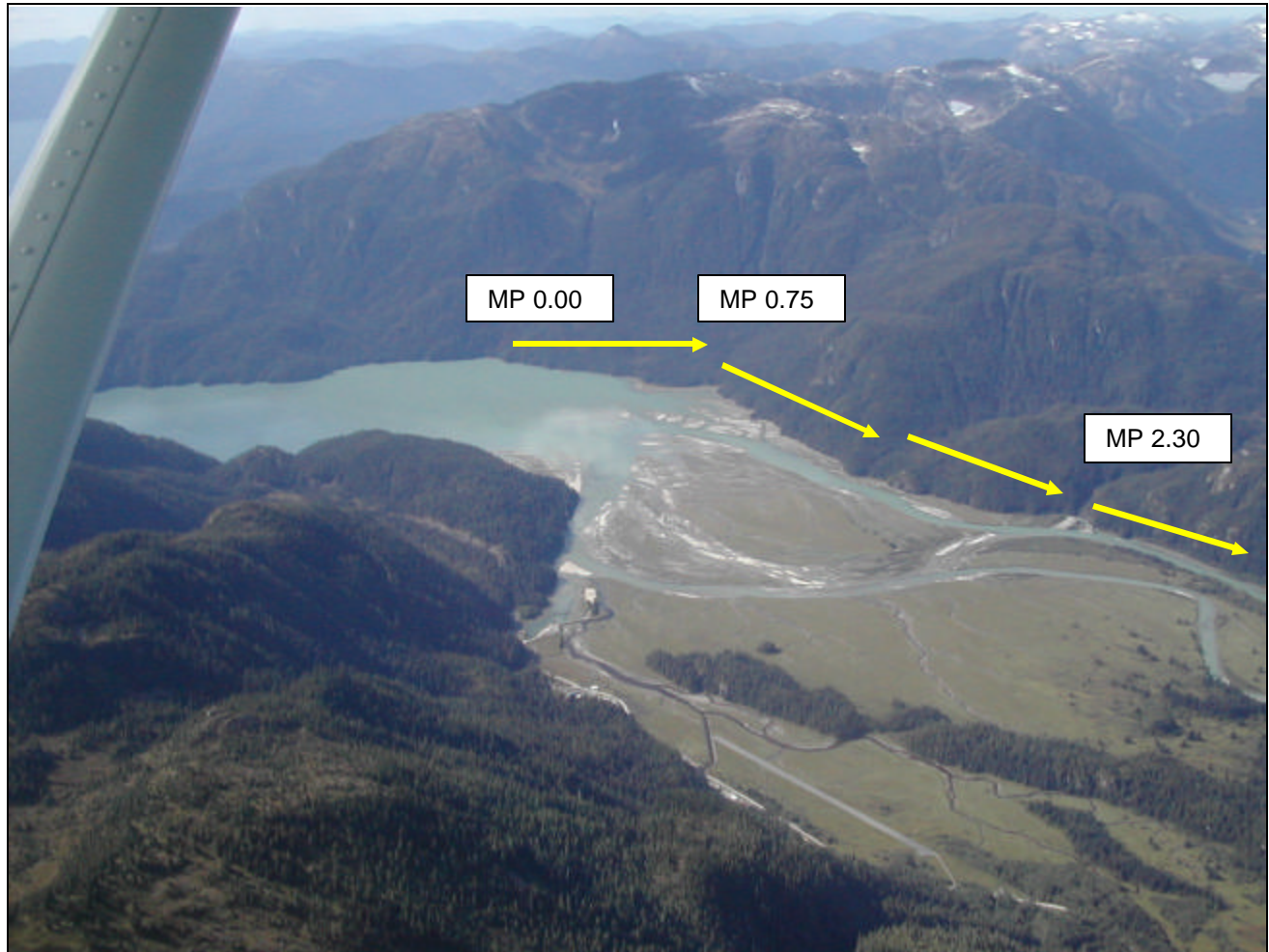
Construction of this segment is anticipated to be moderately difficult. The large, flat flood plains provide for construction staging areas and potential opportunities to utilize excess excavation from the adjacent road segments. This alignment crosses muskeg areas. These crossings will require additional investigation to determine muskeg depth and appropriate stabilization methods.

The CFT designed and evaluated an alignment at MP 3.29 that crossed over to the north side of the North Fork of the Bradfield. However, for this conceptual study, due to the vertical rock slopes on that side of the river and the need for an extensive bridge span, the CFT decided to concentrate design efforts on the southeast side of the North Fork.

#### *Segment 1 Option B, Kapho Mountain*

This conceptual alignment begins at a potential location that may provide deep-water access to the north side of the mouth of the Bradfield Canal. It is also the most westerly point that contains current LIDAR data and where a geometric design can begin. For approximately 3.4 miles the alignment is adjacent to the Bradfield River and is generally positioned on steep, rocky side slopes that will require full bench blasting and retaining walls to contain the full roadway width. At MP 0.75 the alignment crosses a confluence of three stream drainages, and will require an estimated 685-foot bridge structure. The alignment continues along the base of the rock cliffs, above the river channel to MP 2.30, where it crosses a large drainage and will require an estimated 225-foot bridge span. The same terrain features continue along the alignment approximately up to MP 3.50. At this point the Bradfield River bends to the southeast as the conceptual road alignment continues toward the northeast, along the base of the mountainside, but includes the additional area to utilize the excess excavation in the conceptual road design. At MP 4.55, the alignment crosses approximately 0.30 miles of muskeg flood plains to milepost 4.85, where the North Fork of the Bradfield River could be crossed. The river crossing is estimated to require a 335-foot bridge to reach the alignment terminus at MP 4.94.

**Figure X.2 Segment 1, Option B, Kapoho Mountain**



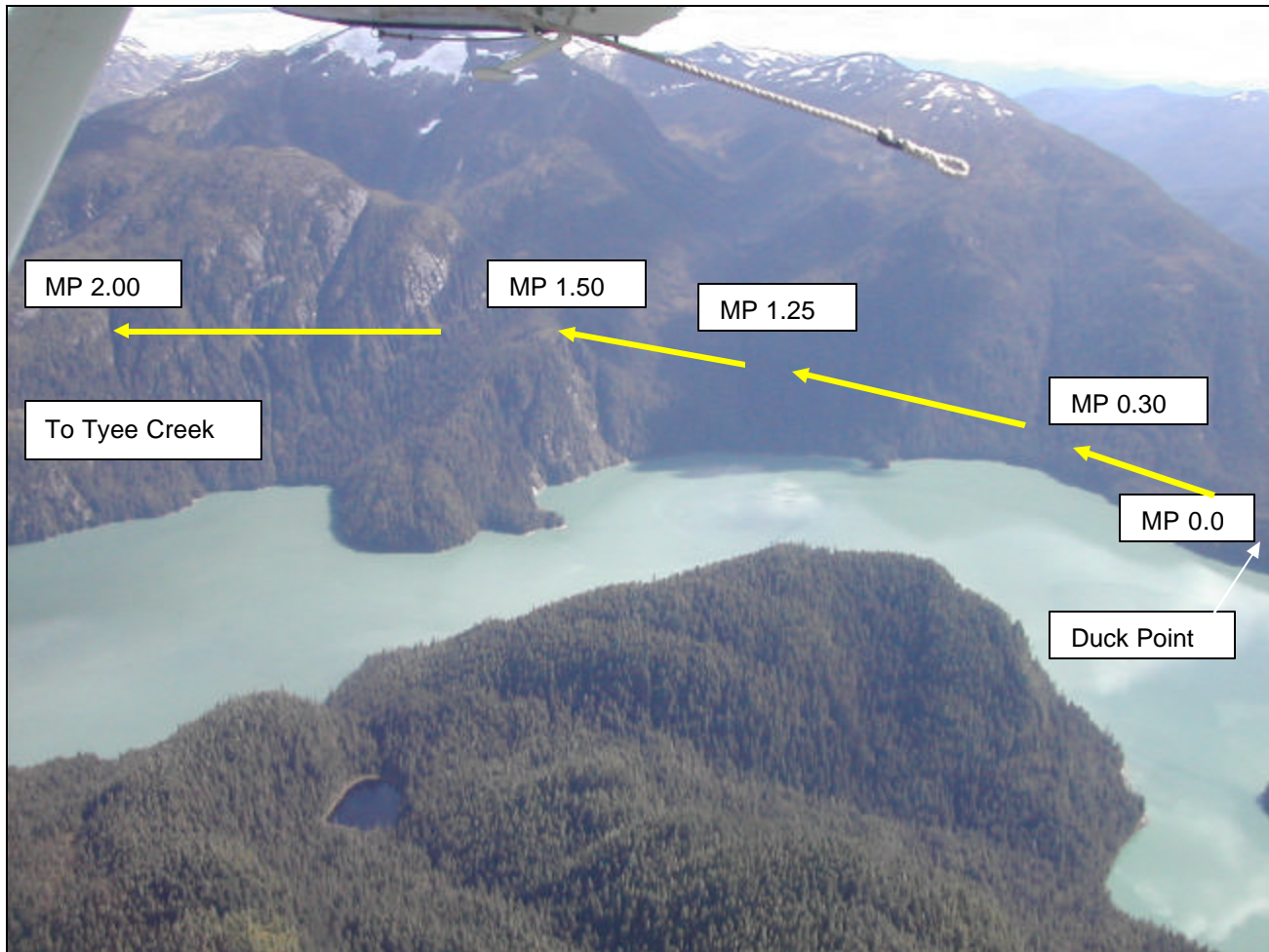
Construction of this segment is anticipated to be very lengthy and difficult. The large, full bench cuts into solid rock will pose considerable challenges for containing the excavation materials during blasting, as well as construction of the long bridge spans. In addition, the first 3.5 miles contain limited opportunities to use the excess excavation, and may require long hauls to place excess excavation and unsuitable materials. The portion of the road between mileposts 3.54 and 4.94 does provide an opportunity to utilize the excess excavation in the roadway, and is adjacent to flat muskeg areas that could be utilized as construction staging areas.

#### *Segment 1 Option C, Duck Point*

The alignment from Duck Point to the Tyee Hydroelectric Project facility was located outside the initial scope of this study and was not included in the LIDAR and orthophotography of the project. The conceptual alignment and profile shown on this option is conceptualized from U.S. Geological Survey (USGS) topography maps of the area. All quantities reflected in the cost estimate are estimated on a route-mile cost basis, not on geometric design quantity-based numbers.



**Figure X.3 Segment 1, Option C, Duck Point**



The conceptual alignment shown on the plans anticipates a full bench cut into solid rock beginning approximately at MP 1.50, and continuing to approximately MP 3.00. The vertical solid rock cliff face in this area will require extensive analysis to determine if an overland route through this area is possible. Major drainages located at approximately MP 0.30 and MP 1.25 will require significant bridge structures and require further analysis to determine the appropriate length and type of structure. From approximately MP 1.50 to 2.00 there are several deeply incised avalanche chutes cut into the vertical rock cliff face, an alignment crossing horizontally along these chutes would require extensive geotechnical and engineering analysis to determine if an alignment is even feasible. Topography maps indicate the rock cliffs rise to an elevation of approximately 2500' and there does not appear to be an alternative route over the top of mountain.

Assuming an overland route is possible, the large, full bench cuts in solid rock anticipated along the cliff faces will pose considerable challenges to drilling and blasting. Containment of the excavation materials during blasting will also pose significant problems. Long hauls to place excess excavation can be anticipated because the conceptual alignment contains limited opportunities to utilize the materials. Road construction around the solid sheer rock cliffs along the alignment

may utilize features such as elevated causeways and retaining walls to limit the high excavation costs.

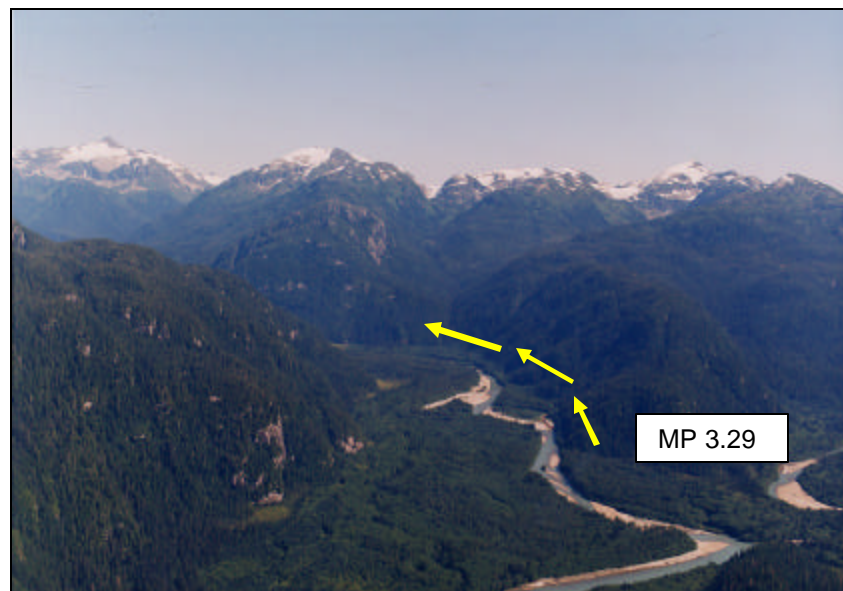
Safety considerations, environmental impacts, and the high cost of an overland route suggest that a tunnel should be studied as an alternative to standard road construction.

### *Segment 2*

This conceptual road alignment begins at the same intersection point as the ending stations from Segment 1 Option A, Option B, and Option C: MP 3.29. This milepost is located just past the confluence of the East and North Forks of the Bradfield River, and marks the end of the tidal salt flats. Remnants of an abandoned logging road can be seen throughout this segment and in the ensuing segments up to MP 16.00.

This conceptual alignment begins along the base of a steep rocky mountain slope with large cuts and retaining walls on the fill side. At milepost 3.70, the river meanders to the west side of the valley floor and the alignment stays to the east along the base of the mountainside, allowing large fills to be designed in, up to MP 5.75. From milepost 5.75 to 6.00, the river flows against a large rock outcropping, requiring deep cuts and retaining walls to be designed in. From MP 6.00 to the end of the segment at MP 6.78, the valley floor opens up again, and the road prism can be constructed utilizing fill material.

**Figure X.4 Segment 2**



Revetment walls were placed at locations to offset the erosion potential of the river while retaining walls were designed to limit the embankment from encroaching into the river. Revetment wall and retaining wall locations were based on cross sections of the alignment and a rough analysis of the stream flow. The conceptual alignment is designed to stay at the base of the surrounding forested mountain slopes, while trying to keep a minimum elevation of 20 feet above the current mean high water level. The now abandoned 14 miles of logging road was laid out in the late 1970's and utilized river borrow as a material source. It has since been washed out in many

locations by the changing river channel. The meandering river channel is in a constant state of flux due to the introduction of sediment from the glacial melt and surrounding mountain drainages.

The two areas with large cuts will present some construction issues but overall, construction is expected to be moderately difficult. There are opportunities along this segment to utilize the excess excavation in the road embankment, thereby limiting haul costs.

### *Segment 3*

This segment of alignment begins at MP 6.78, where the river valley has widened out and the river channel has meandered to the west side of the valley. The road alignment continues up the east side of the valley, and is positioned against the toe of the mountain slope. At approximately MP 7.10, the valley narrows and the alignment remains east of the river, while trying to maintain a grade 20 feet above the waterline. As the river channel meanders and bends, the conceptual road alignment has been designed to include more revetment walls. Further analysis will be required to determine the appropriate size for the riprap in the revetment walls to ensure embankment stability. At approximately MP 9.05, the alignment crosses on the west side of a confluence of two streams, which is anticipated to require a 280-foot bridge. The location of this crossing will require further investigation to ensure the bridge is placed in a stable location.

At approximately MP 9.50, the river again meanders to the west side of the valley floor, while the road continues along the toe of the east slope. Although the alignment in this area is a considerable distance from the river channel, several overflow channels meander up against the toe of the east slope. Because the river channel is in constant migration, it is necessary to maintain a minimum 20-foot elevation above the high water level. Maintaining this grade in steep side slopes requires designing in additional Mechanically Stabilized Earth (MSE) walls to contain the fill, and prevent encroachment into the overflow channels. From approximately MP 11.10 to MP 11.30, the river channel turns abruptly into the east slope, where steep rock outcrops are located. This situation creates a combination of large cuts in the rock and retaining walls to contain the road embankment. This is an area that will require special consideration and engineering to ensure the road alignment is properly located. From MP 11.30 to the segment terminus at MP 12.33, the alignment continues along the east side of the valley, away from the river channel.



**Figure X.5 Segment 3**



The abandoned logging road is still visible in many areas, meandering thru the floodplain. This segment of proposed new alignment is conceptualized in a more stable location, and is anticipated to require approximately 1.4 million cubic yards of excavation. Further evaluation and engineering should reveal opportunities to reduce the excavation quantities, but the steep side slopes along this segment will increase the costs of road construction.

#### *Segment 4*

Segment 4 of this proposed design alignment begins at MP 12.33, and continues along the east side of the valley floor, while the river channel is located up against the west side of the valley. At approximately MP 12.75, the alignment crosses a drainage that will require a bridge structure of approximately 140 feet. As noted previously, the bridge lengths are rough estimates generated from the LIDAR survey and orthophotography, and any change in the conceptual alignment will affect the lengths and types of bridge structures. At approximately MP 13.65, the river meanders back up against the easterly slope where the alignment is located, and limits the placement of embankment slopes, thru cuts and retaining walls that are necessary to reduce the footprint of the roadway.

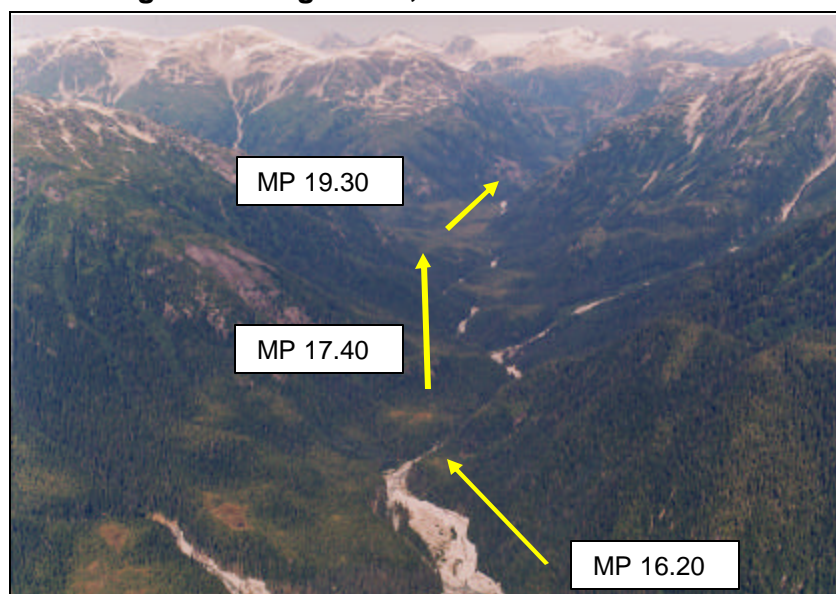
At approximately MP14.00, the main confluence of the North Fork of the Bradfield River meets another drainage that is also mapped as the North Fork of the Bradfield

River. The alignment continues along the northeastern slopes of the valley, crossing the easterly drainage mapped as the North Fork of the Bradfield River at MP 14.75. This drainage crossing has a narrow steep channel that abruptly fans out into the Bradfield River Valley, so the conceptual design anticipates a curved bridge structure approximately 500 feet in length. From MP 16.00 to MP 16.50, the river channel is again located up against the easterly slopes of the valley floor, thereby restricting the placement of embankment slopes. As the river abruptly turns toward the northeast, the channel becomes more restricted and provides opportunity to cross over to the west side of the Bradfield River Valley at approximately MP 16.70, which will require an approximately 360-foot bridge. The slopes of the west side of the valley are also steep and require the use of retaining walls and thru cuts to prevent the footprint of the roadway from encroaching into the river.

One important factor is that at approximately MP 17.40 a sizeable tributary on the east side of the valley continues to release a considerable amount of sediment and boulders. It appears the mass events that created the alluvial fan at the valley floor may have been fairly recent, and this factor directly affected the decision to cross to the west side of the North Fork prior to reaching this location.

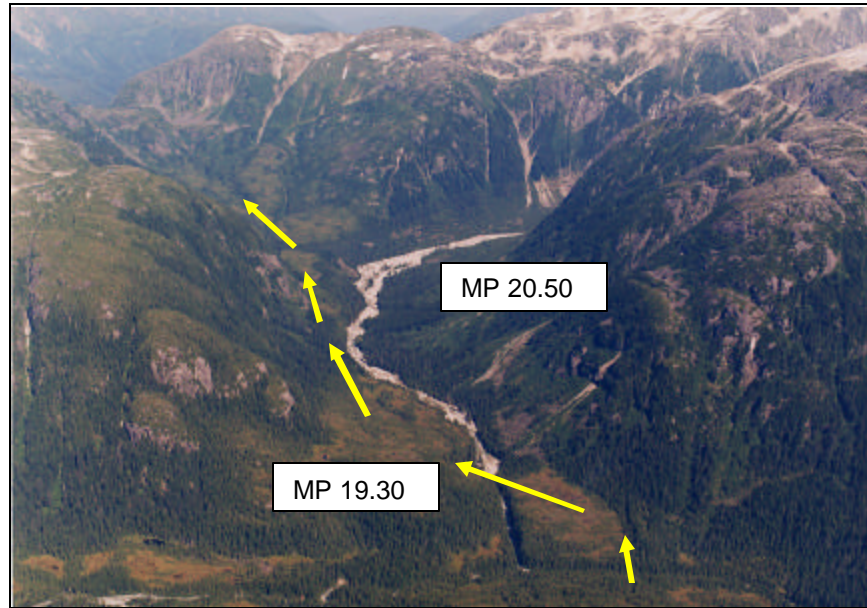
At MP 18.96, a 360-foot bridge crossing is necessary, while an additional bridge crossing is required at MP 19.30. An alternative alignment that would pass northwest of MP 18.96 and require only one bridge crossing was analyzed, but the slopes in the confined channel were too steep to place a geometric alignment. Up river of MP 19.30, the alignment continues in a northerly direction and stays on the west side of the valley up to the southern tunnel portal. At MP 20.50, prior to the tunnel portal, the river channel makes an abrupt turn to the east. The drainage area in which the southern portal is located is broken by ridges and many glacial tributaries that will require fairly large culverts along the alignment. The steep grade leading up to the portal was designed at 9.3 percent to limit the amount of excavation, and future analysis may be able to further reduce the grade. The terminus of this segment of conceptual road alignment is MP 21.06.

**Figure X.6 Segment 4, MP 16.20 to MP 19.30**





**Figure X.7 Segment 4, MP 19.30 to MP 20.50**

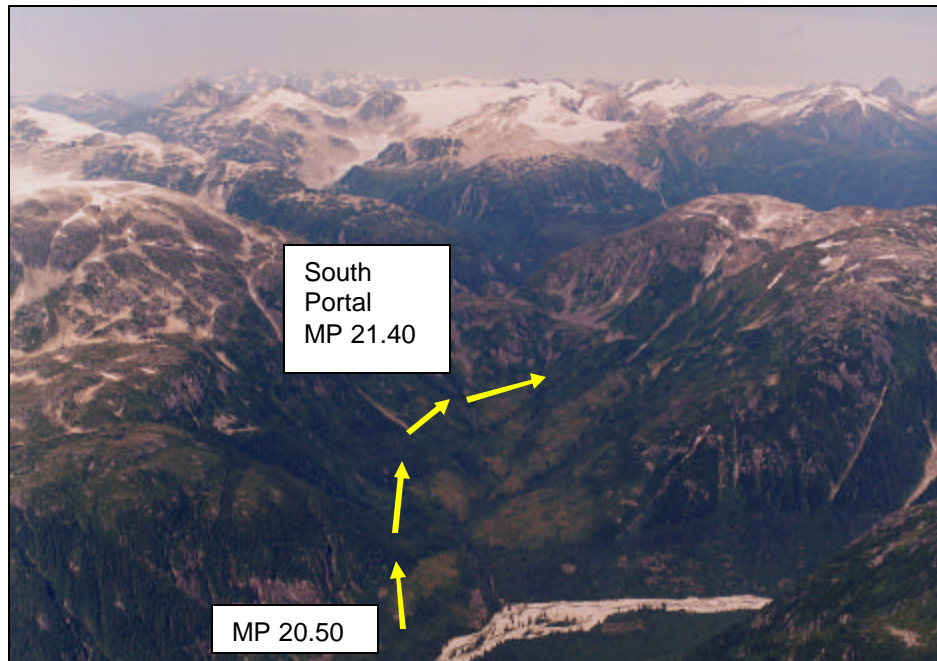


This segment of conceptual alignment contains many challenges for the construction of a transportation corridor. Due to the steep valley slopes, hard granitic rock, and five locations that require bridges, the excavation process will be costly and time consuming. More refined engineering may be able to reduce the excavation quantities but there are limited areas where excess excavation can be used, and some long hauls may be necessary.

#### *Segment 5*

From approximately MP 21.06 to MP 21.20, the alignment is located at the confluence of two sizeable drainages that will require large culverts with deep fills to construct the steep 8.3 percent grade up to the proposed southern tunnel portal. Refer to Appendix E for an analysis of the tunnel alignment.

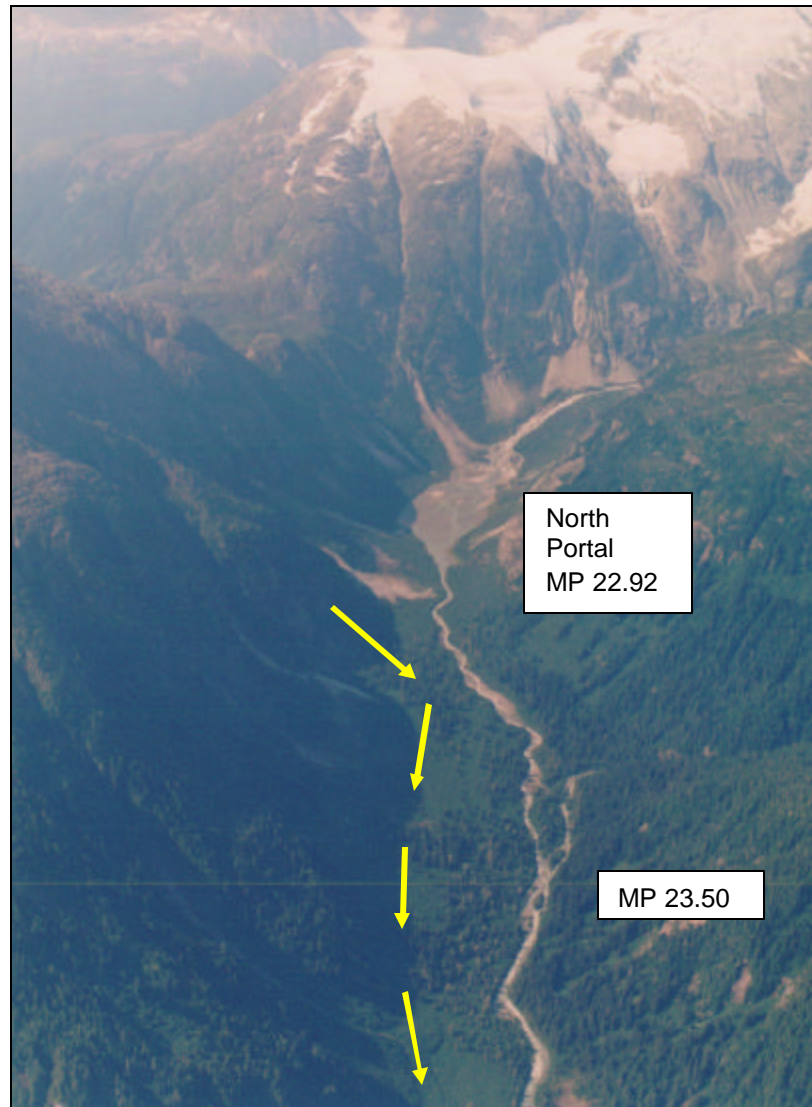
**Figure X.8 Segment 5, Approach to South Portal**



The alignment exiting the northern portal traverses a -5.6 percent grade on large fills. Excavation materials from the tunnel could be utilized in constructing the proposed grade. As the alignment exits the portal, the location was balanced between the head of the Craig River to the west, and the avalanche chutes that come off of the glaciers above the east side of the Craig River Valley. Further analysis will be necessary at approximately MP 23.75 and MP 24.15, to ensure adequate stability where the alignment follows the toe of two wide alluvial fans.

At approximately MP 24.50, a stream crossing will require an anticipated 185-foot bridge structure. The alignment continues in a northeasterly direction at the toe of the Craig River Valley. At MP 25.20, an overflow channel from the Craig River meanders up against the alignment along the eastern slopes for about 1,000 feet, which requires the alignment to be designed into the mountain slope, and necessitates sizeable thru cuts. The valley floor then opens up, and the river channel veers to the northeast while the alignment follows the toe of the mountain slopes in an easterly direction. At MP 26.05, the river channel again meanders back toward the toe of the slopes, but there is ample room to construct the road alignment utilizing fill material. The alignment continues to approximately MP 26.60, where a drainage will necessitate a 365-foot bridge structure crossing. The drainage is located on the toe of an alluvial fan, and further analysis will be required to ensure that this is the proper crossing location. The road alignment continues in a northeasterly direction to the U.S./Canada border, to the terminus of this segment at MP 27.44.

**Figure X.9 Segment 5, North Tunnel Portal at Craig River**



This segment of road alignment poses several construction challenges as it traverses several alluvial fan areas that will require additional exploration. However, overall the majority of the conceptualized alignment grade utilizes the anticipated excess excavation materials from the tunnel construction. The adjacent slopes appear to provide opportunities to place large amounts of fill material, on which the road can be located. The area of greatest concern is the segment leading up to the southern portal, where construction of large fills and large culverts will be time consuming and costly.

## **Roadway Cost Estimate Summary**

Costs are based on bid tabulations extracted from WFLHD project AK PFH 44-1(1), Coffman Cove Schedule B. Bid tabulations on the Coffman Cove Project were received in fiscal year 2003. All bid items and unit costs were reviewed by WFLHD field personnel to ensure unit costs were appropriate and still applicable. WFLHD

CFT also reviewed bid items and unit costs; their input was also taken into consideration in developing the final unit costs reflected in the Conceptual Cost Estimate Summary table. Item descriptions, conceptual quantities developed, unit costs and cost estimate background information are provided in the full WFLHD report. Construction costs for the options are summarized in the following table.

### **Bradfield/Iskut Transportation Corridor US Road Construction Cost Estimates**

	<b>Tyee Creek Option</b>	<b>Kapho Mtn Option</b>	<b>Duck Pt. Option</b>
MOBILIZATION	\$13,213,977	\$14,245,915	\$19,035,914
EARTHWORK	\$29,385,543	\$34,091,552	\$81,940,124
UTILITIES & RELOCATIONS	\$2,873,151	\$2,955,651	\$3,109,651
BASES & PAVEMENT	\$6,166,720	\$6,444,480	\$7,201,240
TUNNEL	\$73,636,000	\$73,636,000	\$73,636,000
STRUCTURES	\$30,855,500	\$37,025,000	\$43,986,800
INCIDENTAL CONSTRUCTION	\$10,267,194	\$10,400,244	\$10,653,099
ROADWAY FINISHES	\$2,383,890	\$3,209,190	\$2,553,296
<b>SUBTOTAL ROADWAY AND BRIDGE WORK</b>	<b>\$168,781,974</b>	<b>\$182,008,032</b>	<b>\$242,116,124</b>
CONTINGENCIES: 25%	\$42,195,494	\$45,502,008	\$60,529,031
<b>TOTAL CONSTRUCTION COST</b>	<b>\$210,977,468</b>	<b>\$227,510,040</b>	<b>\$302,645,154</b>
CONSTRUCTION ENGINEERING SERVICES: 8%	\$16,878,197	\$18,200,803	\$24,211,612
EIS W/ SUPPORTING ENGINEERING: 5%	\$6,682,983	\$7,509,612	\$11,266,368
DESIGN ENGINEERING & ADMINISTRATION: 8%	\$12,460,037	\$13,782,643	\$19,793,452
<b>TOTAL CONSTRUCTION &amp; ENGINEERING</b>	<b>\$246,998,686</b>	<b>\$267,003,098</b>	<b>\$357,916,587</b>
Construction Cost \$/Mile	\$7,680,994	\$7,813,524	\$9,399,656
Option Length (miles)	27.47	29.12	32.20

## **Marine Terminal**

### **Site Locations and Available Information**

Two locations were considered for the terminal site as illustrated in WFLHD's Segment 1 aerial map. Kapho Mountain is located on the north side of Bradfield Canal near Station 0+00 of Segment 1B. Duck Point is located on the south side of the canal near Station 0+00 of Segment 1C. The Tyee Creek option of Segment 1A was not considered due to concerns over steep terrain at that location made evident by recent LIDAR surveys.

Site visits and new investigations were not conducted for this ferry terminal study. Available site information for Kapho Mountain and Duck Creek is quite limited and consists only of high altitude aerial photographs and 1:80,000 NOAA chart data. Bathymetric survey data was not available for these sites and the LIDAR topographic survey was not extended to these locations as it was collected prior to their consideration.

## Terminal Facility Description

The marine facilities envisioned for either site consist of a short span of pile supported approach structure extended offshore to adequate water depth. A steel transfer bridge is hinged from the approach structure to support vehicle and passenger loading operations. The bridge is supported offshore by a floating steel pontoon or bridge float. The transfer bridge system includes an intermediate ramp and vehicular apron and the bridge float is equipped with fenders, pile restraints and various access platforms and gangways to support mooring operations. A string of six mooring and breasting dolphins are anticipated to align the berth along a seafloor contour of approximately minus 35 feet MLLW. Gangway access is provided to mooring bollards at each dolphin.

Upland improvements anticipated for the facility include development of an approximately three-acre site for parking, staging and support structures including a 3,000 square foot terminal building and a 2,000 square foot maintenance facility. On-site water and sewer utilities are envisioned for this remote location. Electrical power may be supplied via a utility extension from the Tyee Power Plant or by on-site generator.

Total recommended project budget for the ferry terminal including design, construction, administration and 15 percent contingency is estimated at \$12.5 million. The budget can be applied to either location; however, it should be regarded as preliminary due to the rough level of information available to engineers at the time of estimating. The estimate should be updated following collection of more specific site information.



**Bradfield/Iskut Transportation Corridor  
Marine Ferry Terminal Cost Estimate**

Item	Item Description	Units	Quantity	Unit Cost	Amount
1505.1	Mobilization	LS	All Req'd	9%	\$723,510
1560.1	Temporary Erosion and Environmental Controls	LS	All Req'd	\$25,000	\$25,000
2201.1	Clearing and Grubbing	AC	3	\$7,500	\$22,500
2202.1	Excavation	CY	5,000	\$10	\$50,000
2202.2	Shot Rock Borrow	CY	45,000	\$15	\$675,000
2202.3	Subbase, Grading A	CY	5,000	\$18	\$90,000
2204.1	Base Course Grading D-1	CY	2,500	\$30	\$75,000
2205.1	Riprap	CY	5,000	\$30	\$150,000
2401.1	On Site Sanitary Sewer Treatment System	LS	All Req'd	\$150,000	\$150,000
2501.1	Storm Sewer System	LS	All Req'd	\$60,000	\$60,000
2601.1	Domestic Water System	LS	All Req'd	\$100,000	\$100,000
2702.1	Construction Surveying	LS	All Req'd	\$60,000	\$60,000
2707.1	Security Fencing	LF	500	\$30	\$15,000
2708.1	Guardrail	LF	1,000	\$40	\$40,000
2710.1	Topsoil, Seeding, Landscaping	LS	All Req'd	\$30,000	\$30,000
2714.1	Geotextile Separation	SY	5,000	\$2	\$10,000
2718.1	Sign Assemblies	LS	All Req'd	\$5,000	\$5,000
2720.1	Painted Traffic Markings	LS	All Req'd	\$20,000	\$20,000
2801.1	Asphalt Concrete Pavement	TON	2,000	\$125	\$250,000
2901.1	Mooring & Breasting Dolphin	EA	6	\$250,000	\$1,500,000
2901.2	Access Gangways	LF	400	\$500	\$200,000
2901.3	Steel Approach Structure	LS	All Req'd	\$500,000	\$500,000
2901.4	Steel Transfer Bridge	LS	All Req'd	\$700,000	\$700,000
2901.5	Steel Bridge Float	LS	All Req'd	\$700,000	\$700,000
2901.6	Intermediate Ramp and Vehicle Apron	LS	All Req'd	\$400,000	\$400,000
2901.7	Float Platforms, Fenders & Restraint System	LS	All Req'd	\$500,000	\$500,000
3301.1	Bridge Abutment	LS	All Req'd	\$50,000	\$50,000
3303.1	Concrete Curb	LF	500	\$25	\$12,500
3303.2	Concrete Sidewalk	SY	400	\$60	\$24,000
11000.1	Terminal Building	SF	3,000	\$200	\$600,000
11000.2	Maintenance Building	SF	2,000	\$200	\$400,000
11000.3	Fuel Storage	LS	All Req'd	\$100,000	\$100,000
16000.1	Electrical Power System	LS	All Req'd	\$250,000	\$250,000
16000.2	Area Lighting	LS	All Req'd	\$100,000	\$100,000
16000.3	Communication System	LS	All Req'd	\$200,000	\$200,000
ESTIMATED CONSTRUCTION BID PRICE					\$8,787,510
CONTINGENCY (15%)					\$1,318,127
ENVIRONMENTAL STUDIES & PERMITS					\$200,000
TOPOGRAPHIC & BATHYMETRIC SURVEYS					\$75,000
GEOTECHNICAL INVESTIGATION					\$200,000
ENGINEERING DESIGN, FINAL P,S&E (10%)					\$878,751
CONTRACT ADMINISTRATION & CONSTRUCTION INSPECTION (10%)					\$878,751
<b>TOTAL RECOMMENDED PROJECT BUDGET</b>					<b>\$12,338,139</b>

### **Introduction**

The cost estimates for the Canadian portion of the Bradfield to Cassiar Highway 37 Bradfield/Iskut Connector were prepared by McElhanney Consulting Services Ltd. specifically for this study. The alignment, grades and cross-slopes developed by Peratrovich, Nottingham & Drage (PN&D), Inc. for the Ketchikan/Bradfield/Cassiar Transportation Corridor Study prepared in November 1994. It is important to recognize that the cost estimates for these respective portions of the route are based on different levels of available information. The section from the US/Canada border to the Snip Mine (Mile Post 29 to 47) along the Craig River has the highest degree of uncertainty with limited information, whereas the section from the Snip Mine to the Eskay Creek Mine turn-off has had a number of significant studies and was 'field checked' using a helicopter by McElhanney as part of a potential Galore Creek Mine Road this summer. While both estimates should be viewed as preliminary, the highest degree of uncertainty lies with the cost of constructing the Craig River section.

### **Objectives**

The objectives of this engineering study are to develop cost estimates for road access from the US/Canadian border to the existing road system near Volcano Creek in British Columbia for both a one-lane (6 m) pioneer road and two-lane (7.2 m) alternative.

### **Methodology**

The study was accomplished through the use of available reports and maps along with the helicopter recon of a portion of the route. The first task was to assemble and review the various reports that have been previously prepared for this route. These reports include a Route Reconnaissance Study prepared by the Alaska Department of Transportation and Public Facilities (ADOT/PF), Bradfield Industrial Road Feasibility Study by S. C. Jacoby and Associates, Iskut Valley Road Option Study by Thurber Consultants Limited and the 1991 Iskut Road Study by Klohn Leonoff et al.

The next step was to define the design criteria that would be appropriate for the facilities being considered. Design criteria were derived from the Canadian TAC standards which were comparable to the American standards.

Typical sections were developed and construction quantities per mile were developed for topography with varying ranges of cross slope. Quantities were then calculated on a spread sheet. Major drainages and associated structures were identified from the PN&D report.

Cost estimates were then prepared on a unit price basis using previous bid tabulations. Detailed information is provided in the appendices to this report.

# Road Engineering

## Route Description

The road alignment proceeds down the southeastern side of the Craig River flood plain, adjacent to the mountainside in a north to northeasterly direction. The terrain is gravel outwash plain. Occasionally the Craig River meanders against the valley wall (MP 34 to 36, MP 37.5 and MP 38.7), which requires that rip rap protection be installed to prevent erosion of the road embankment. At MP 39.7 Jekill River is crossed, and the alignment switches to the north continuing along the east valley wall of the Craig River flood plain, then curves to the northeast through a low saddle at MP 44. Bronson Creek is crossed at MP 45.3.

The alignment then follows the south wall of the Iskut River Valley in an easterly direction crossing Snippaker Creek at MP 54, where it then changes direction to east northeast to its terminus at MP 65 at Volcano Creek

## Design Alternatives

The road design alternatives include a one-way gravel pioneer road and a two-way asphalt public road.

## Design Criteria

Design criteria adopted for the project road are summarized in the following table:

**Iskut Area Road Construction Design Criteria**

Feature	Two-Lane Road	Pioneer Road
Design Speed	50 KMPH	50 KMPH
Degree of Curvature (Max)	15	15
Grade (Max.)	8% (short pitches of 10%)	8% (short pitches of 10%)
Surface Width	7.2 m	6m
Number of Lanes	2	1 with Pull-outs @ 1000' Intervals
Surfacing	Asphalt	Crushed Gravel

## Avalanche Facilities

The estimates do not include avalanche facilities. Because of relatively low traffic volumes and the extreme cost of avalanche sheds, it is assumed that avalanches will be dealt with through avalanche control measures such as explosives or artillery to bring down dangerous build-ups. Another option is to keep the road closed when avalanche danger is present.



## Summary of Capital and Maintenance Costs

### Capital Costs

Construction costs for a 6-meter pioneer road are estimated to be about C\$64 million including design and construction engineering and contingency. This road would be constructed to resource/recreation use standards. Currently, a resource road is in place between the Cassiar Highway and Volcano Creek. Construction costs are calculated only for the 65-mile (105 km) link between Bradfield and Volcano Creek. For the 7.2-meter two-lane road the construction costs are estimated to be about C\$96 million.

**Bradfield/Iskut Transportation Corridor  
BC Road Construction Cost Estimates (Can \$)**

	6 meter Gravel	7.2 meter Paved
Construction Cost	40,280,000	61,004,000
Mobilization ~7% of total	2,820,000	4,270,000
Geotechnical 3%	1,208,000	1,830,000
Environmental 5%	2,014,000	3,050,000
Engineering & Surveying 8%	3,222,000	4,880,000
Construction Supervision 5%	2,014,000	3,050,000
Contingency 30%	12,084,000	18,301,000
<b>Total</b>	<b>63,642,000</b>	<b>96,386,000</b>

### Maintenance Costs

Previous annual maintenance cost estimates for the road extension vary widely from C\$0.6 million to C\$2.9 million per year as shown below. These variations are partly due to different standards assumed for the road and snow removal requirements. A benchmark would be the maintenance costs for the existing Eskay Creek road, which is 36 miles in length, about the same length as Bradfield/Iskut road in Canada.

**BC (Iskut) Road Maintenance Cost Estimates  
from Previous Studies (Can \$)**

Source	Iskut River 19 miles	Craig River 16 miles	Total 35 miles
Tahltan Development Corp. (2003)	\$500,000	\$500,000	\$1,000,000
Clayton (1989)	600,000	500,000	1,100,000
McDowell-PND (1994)	300,000	500,000	800,000
US Forest Service (1998)	1,000,000	1,000,000	2,600,000

Tahltan Nation Development Corporation has C\$1 million/year contract to maintain the Eskay Creek road. More than half of this cost is for snow removal along the last 6 miles of the road just ahead of the Eskay Creek mine. Maintenance costs along the lower elevations part of Iskut River section are lower. Based on the higher anticipated snowfalls heading west of Eskay Creek, a maintenance allowance of C\$1.2 million (US\$840,000) is recommended.

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## II. BENEFIT/COST ANALYSIS

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The purpose of this analysis is to measure the net economic feasibility of development of the Bradfield/Iskut corridor. This includes summarizing and comparing all measurable benefits and costs for the 30-year study period.

Net present value and benefit/cost measures are used to assess the economic viability of the proposed road construction project. The net present value (NPV) is the current value of a future stream of costs and benefits. If the NPV is greater than zero, the project is economically justified. Similarly, if the benefit cost ratio is greater than one, the project is economically feasible.

### Summary of Benefits

Economic benefits related to the development of the Bradfield/Iskut transportation corridor include mining, forest products and seafood-related industrial benefits. Benefits also include regional spending by travelers using the new highway.

**Mining:** A Bradfield/Iskut road offering improved access to the richly mineralized Iskut and surrounding areas would reduce exploration costs, costs associated with mine development, and cost of mine operations. In particular, the road could provide developers of the proposed Galore Creek and Red Chris mines improved access to tidewater, potentially resulting in millions of dollars in annual transportation-related savings. Total annual benefits of \$8 million are assumed in the benefit/cost analysis. This assumes substantial annual benefits for Galore Creek, or a similarly sized project, plus substantial benefit in terms of exploration activity.

**Forest Products:** Construction of the Bradfield/Iskut road would improve access to timber stands in the Iskut valley and could spur additional harvests. An annual harvest of 30,000 m<sup>3</sup>/yr (13 million board feet, mmbf) with a gross value of \$3.8 million is predicted to stem from improved access to the area.

In Alaska, road construction could spur timber harvests along the road corridor. This analysis assumes that improved access would stimulate a harvest of 5 mmbf annually from the valley for five years, resulting in 25 mmbf total harvest. This timber would be processed by Southeast mills and would generate a total direct economic value for Southeast Alaska of \$1.5 million annually.

With road construction, timber stands in the Iskut Valley could provide feed stock for Southeast sawmills. It is possible that Tahltan harvests (and other harvests that have no export restrictions) could be one component of a timber supply base that supports a larger integrated industry, including an MDF plant (for example).

**Seafood Industry:** The Bradfield/Iskut road will provide Southeast Alaska seafood processors improved access to fresh fish markets. Fresh fish demands higher prices in the marketplace. Higher prices mean more income for processors and fishermen.

The benefit of improved access to the continental highway system for Wrangell and Ketchikan processors is estimated at \$1.5 million annually increasing to \$3.4 million annually by the end of the study period.

**General Freight:** It is estimated that about 15,000 tons of general cargo would move on the Bradfield/Iskut road, as freight diverts from more expensive or less timely transportation modes. This would translate into the equivalent of about 1,500 truck loads. These freight traffic estimates do not include any traffic that might be generated by resource development in the Iskut or Highway 37 corridors.

When the Ketchikan Access project (the road to Bradfield) is completed, freight traffic on the Bradfield would increase, with a the total freight volume of approximately 40,000 tons, or the equivalent of about 4,000 truck loads per year. The economic value of moving this freight over the Bradfield/Iskut corridor is estimated at \$1.5 million initially increasing to \$5.5 million by the end of the study period.

**Electric Intertie Benefits:** The Bradfield/Iskut road corridor would reduce construction costs, if an interconnection between Coast Mountain Hydro and the Thomas Bay Power Authority were to be constructed following completion of the road. The road would provide easier access and reduce the costs of staging equipment, hauling in power poles and conductors. It would reduce the need for building construction roads and using airlifts.

An Alaska/BC interconnection via Bradfield could potentially benefit both parties, and could allow Alaska to be interconnected to the North American grid and allow better utilization of transmission capacity to BC Hydro's system.

**Personal Travel:** Total spending by highway travelers in the Bradfield/Iskut and Highway 37 areas would be approximately \$2.2 million in 2011, \$6.1 million in 2016, and \$8.7 million annually in 2034. These estimates assume Ketchikan Access is in place by 2016. In the absence of Ketchikan Access, Bradfield-related spending would total \$2.3 million in 2011, \$2.7 million in 2016, and \$3.9 million annually in 2034.

Economic benefits related to the development of the Bradfield/Iskut corridor are summarized in the following table.

**Summary of Potential Economic Benefits  
Associated with Development of the Bradfield/Iskut Corridor**

	Range of Potential Annual Benefits	Total Potential Benefits over Study Period
Mining	Up to \$8 million	\$170 million
Forest Products	Up to \$5.3 million	\$27 million
Seafood	\$1.5 million to \$3.4 million	\$60 million
Personal Travel	\$2.3 million to \$8.7 million	\$145 million
General Freight	\$1.5 to \$5.6 million	\$90 million
<b>Total Benefits</b>	<b>\$20 million to \$26 million</b>	<b>\$492 million</b>

Annual benefits, for each year of the study period, are presented in the appendices to this report.

Because of the high level of uncertainty in predicting future commercial and industrial activity around transportation infrastructure development, it is sometimes informative to conduct a risk analysis. This typically involves assigning probabilities to various outcomes. For example, if it is judged that there is a one in two chance

that Galore Creek will be developed, a probability factor of .5 could be applied to expected Bradfield-related benefits associated with that particularly mining project. However, determining probability is in itself a highly subjective exercise. Differential discounting can also be used to reflect uncertainty. Potential benefits that are more uncertain are discounted at a rate higher than benefits or costs that more certain. Another approach to dealing with the uncertain nature of future economic benefits is to conduct sensitivity analysis. That is, consider the benefit/cost and net present value implications of different discount rates, of important benefits not materializing (such as Galore Creek-related benefits), or of higher or lower construction costs. That approach is employed in this study.

## **Summary of Costs**

### **Road Construction and Maintenance Costs**

Road construction costs for the Alaska portion of the Bradfield/Iskut corridor have been estimated at between \$241 million and \$366 million, depending on the location of the marine terminal. These cost estimates are for a two-lane, 24-foot paved highway.

The lowest cost option (Tyee Hydro Option) provides an estimate of the cost from first tidewater, irrespective of the technical feasibility of marine terminal construction at that location. This option, added to BC road construction costs, ferry construction costs and ferry terminal construction costs, represents the base case in this benefit/cost analysis. The effect on project viability of increased construction costs associated with accessing superior marine terminal local locations is addressed in the sensitivity analysis.

The 68 miles (109 km) of road construction along the BC portion of the Bradfield/Iskut corridor would cost approximately \$67 million (C\$96 million). This is the cost for a 7.2 meter, two-lane, paved highway.

These construction estimates include all engineering, environmental and project management costs.

### **Ferry-Related Construction and Operations Costs**

Ferry construction cost data is taken from the Southeast Alaska Transportation Plan (SATP), which placed the cost of a dedicated Bradfield ferry at \$16 million.<sup>107</sup> This figure is used in the benefit cost analysis.

Bradfield ferry operating and maintenance costs are also estimated in the SATP. Annual expenses are estimated at \$1.7 million with revenues of \$2.1 million. For purposes of this analysis it is assumed that the ferry, as well as terminal operations, would operate on a breakeven basis.

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<sup>107</sup> Southeast Alaska Transportation Plan (SATP), Draft Update, January 2004, pg. 62.

## Total Construction and O&M Costs

Total construction costs for the base case are estimated at \$340 million. Annual operating and maintenance costs are estimated \$1.4 million. These costs are summarized in the following table.

**Summary of Construction and Maintenance/Operating Costs  
Bradfield/Iskut Corridor**

	Construction Costs (US \$)	Annual Operations/Maintenance Costs (US \$)
US Road (28 miles, 45 km)	\$247.0 million	\$0.6 million
Canadian Road (68 miles, 109 km)	67.0 million	0.8 million
Bradfield/Fools Inlet Ferry	14.0 million	*
Bradfield Ferry Terminal	12.3 million	*
<b>Total Cost</b>	<b>\$340 million</b>	<b>\$1.4 million</b>

\*It is assumed that revenues will cover the cost of ferry operations and related terminal operations. The SATP assumes a surplus of approximately \$400,000 annually.

Development of the Bradfield/Iskut corridor would occur over a number of years. The environmental impact statement process could require three to four years. Construction of the road could require up to six years. The corridor could be developed with the objective of completing a “pioneer” or resource road from Bradfield to Volcano Creek (including the tunnel) as soon as possible, to provide for the movement of resources (mineral concentrates and timber, primarily). Over time the road could be further developed to the rural collector standard.

For purposes of this study it is assumed that road will be available for industrial traffic in 2011 and will be fully developed by 2014 (with Bradfield ferry service commencing that year).

Total annual construction and maintenance/operations costs, for each year of the study period, are presented in the appendices to this report.

## B/C and NPV Analysis

When comparing future benefits versus future costs, the rate at which costs and benefits are discounted to a present value is critical. As illustrated in the following table, using a discount rate of 3 percent results in a projected net present value of \$108 million and a benefit/cost ratio of 1.6. At a discount rate of 5 percent, the road construction project is just above break-even, with a benefit/cost ratio of 1.1. At 7 percent, however, the net present value falls below zero and the benefit/cost ratio below 1 to 0.9 (7 percent is the rate recommended by the Office of Management & Budget for the evaluation of federal programs whose benefits and costs accrue over time).

### Net Present Value and Benefit/Cost Analysis Bradfield/Iskut Transportation Corridor

Discount Rate	Present Value of Benefits (millions)	Present Value of Costs (millions)	Net Present Value (millions)	Benefit/Cost Ratio
3 percent	\$300	\$192	\$108	1.6
5 percent	\$215	\$196	\$19	1.1
7 percent	\$160	\$187	\$-27	0.9

### Sensitivity Analysis

The economics of the Bradfield/Iskut corridor development project clearly have a high level of sensitivity to the discount rate. Other factors are also very important, such as terminal location, mining benefit assumptions, and others.

The economic viability of the Bradfield/Iskut road is sensitive to the location of the ferry terminal. Potential terminal locations include Duck Point and Kapho Mountain. The cost associated with accessing these sites ranges from \$20 million to \$110 million above the base case cost, which is the cost of road construction from a point at tidewater near the Tyee Hydro station. The Duck Point option (the highest cost option), at 3 percent, has a benefit/cost ratio of 1.2, but is below 1.0 at other discount rates (0.8 at 5 percent and 0.7 at 7 percent). The benefit/cost ratio for the Kapho Mountain option is 1.5 at a 3 percent discount rates, 1.0 at 5 percent, and 0.8 at 7 percent.

The economic viability of the project is also highly sensitive to assumptions about mining-related benefits (where potential industrial benefits are the most speculative). For example, if there are no significant benefits associated with hauling ore concentrates to Bradfield, the net present value of the overall project is negative under all but the 3 percent discount rate scenario (which produces a benefit cost ratio of 1.2).

Similarly, higher or lower than expected construction costs can significantly affect project viability. For example, if construction costs are 25 percent lower than expected (which might be possible with a lower standard road), the net present value of the project would be \$145 million, with a benefit/cost ratio of 1.9 at a 3 percent discount rate, 1.4 at 5 percent, and 1.1 at 7 percent. It should be noted that construction cost estimates include a 25 percent contingency on the US road construction costs and a 30 percent contingency on the BC costs.

### Distribution of Benefits and Costs

Because the Bradfield/Iskut road construction project would be an international effort, it is important to consider the distribution of benefits between Alaska and British Columbia.

Nearly all mining benefits would accrue to the BC economy. Cost savings enjoyed by mining companies would benefit owners, and could prolong mine life as lower cut-off grades are possible with lower costs. Further, labor for mine development

and operations would most likely be entirely from the Canadian labor force. To the extent that the Bradfield/Iskut road spurs mine development, the road would stimulate significant employment opportunities for residents of the northwestern BC area. Alaska could benefit from the relatively small number of jobs created at a Bradfield concentrate loading facility. (This would not necessarily mean that Stewart would lose jobs).

Timber industry benefits would accrue to BC and Alaskan interests. The Tahltans hold significant harvest and export rights for timber in the Iskut area. A smaller volume of timber could be harvested from National Forest on the Alaska side of the border.

Seafood processing-related benefits would accrue to Alaska processors, as they reach into new and larger fresh fish markets.

Benefits associated with movement of general cargo would accrue largely to Alaska shippers and consumers, as they experience either lower cost time-sensitive shipping, or better access to suppliers.

Economic benefits associated with personal recreational travel will be split among Alaskan and BC communities and businesses.

It is possible to roughly estimate the benefit/cost relationship for Canada's investment in the project, as well as the benefit/cost relationship for the US investment in the project. For example, if Canadian benefits are assumed to include essentially all the mining benefits, half the personal/recreational travel benefits, and two-thirds of the timber-related benefits, the present value of Canadian benefits would total \$170 million, based on a 3 percent discount rate. The present value of construction and maintenance costs for the Canadian portion of the road totals \$46 million (also based on a 3 percent discount rate). This suggests a net present value of about \$124 million and a benefit/cost ratio of 3.7. At a 7 percent discount rate, the Canadian portion of the project has a net present value of \$53 million and a benefit/cost ratio of 2.3. US and Canadian project economic viability under different discount rates are summarized in the following table.

#### **US and Canadian Net Present Value and Benefit/Cost Analysis Bradfield/Iskut Transportation Corridor**

<b>Discount Rate</b>	<b>Present Value of Benefits (millions)</b>	<b>Present Value of Costs (millions)</b>	<b>Net Present Value (millions)</b>	<b>Benefit/Cost Ratio</b>
<b>3 percent</b>	<b>\$300</b>	<b>\$192</b>	<b>108</b>	<b>1.6</b>
US	130	146	-16	0.9
Canada	170	46	124	3.7
<b>5 percent</b>	<b>\$215</b>	<b>\$196</b>	<b>19</b>	<b>1.1</b>
US	90	152	-62	0.6
Canada	125	45	80	2.8
<b>7 percent</b>	<b>\$160</b>	<b>\$187</b>	<b>-27</b>	<b>0.9</b>
US	65	146	-81	0.4
Canada	95	42	53	2.3



## ***XIII. FINANCING OPTIONS***

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A project the size of the Bradfield/Iskut project will require funding outside normal highway construction funding channels. Either a special “earmark” appropriation will be required, or creative multiple-source funding. This chapter briefly addresses the various funding avenues that could be considered in the development of a funding package.

### **Alaska Options**

Transportation-related funding comes from several federal agencies, most notably the Federal Highway Administration and Federal Transit Administration. The state receives several categories of funding from each of these agencies. Each category has distinctive rules for project eligibility, match ratios, and other programming factors. The following briefly describes the most significant of the categories that could be applicable to the Bradfield/Iskut transportation corridor.

The Transportation Equity Act – A Legacy for Users (TEA LU) proposes to increase federal funding for highway projects to \$298 billion, and increase transit funding to \$69.2 billion from 2004 to 2009, a 72 percent increase over total funding for Transportation Equity Act for the 21<sup>st</sup> Century (TEA 21) covering the years 1999 through 2003. Alaska’s share of these funds is \$375 million in FY2004 rising to \$510 million by FY2009.

### **National Highway System**

The National Highway System includes highways considered most important to interstate travel, national defense, connection with other modes of transportation, and are essential to international commerce. Currently 2,100 miles of highway and 1,900 miles of ferry routes (including designated terminals and all vessels of the Alaska Marine Highway System) are eligible for NHS funding. The federal funds ratio varies; it is 93.4 percent if spent on an interstate route, or 90.97 percent otherwise. National Highway System funding comprises the lion’s share of the total Federal Highway Program funding to the state.

### **Forest Service**

The Federal Lands Highway Program (FLHP), an adjunct to the Federal-Aid Highway Program, administers highway programs in cooperation with Federal land managing agencies within the Department of the Interior (DOI) and the Department of Agriculture (USDA). The FLHP was reauthorized as a feature of the TEA 21. The FLHP allocated \$165 million annually for each of the fiscal years 1999 through 2003 to the states for logging roads on national forest lands. Alaska’s share of these funds was approximately \$7 million annually. This funding is currently before Congress for reauthorization.

The National Forest Administrative Road Network consists of forest roads used primarily for administration of the National Forest System Lands, its resources, and

dispersed recreation access for activities such as fishing, hunting, berry picking, and pleasure driving. These roads tend to be the lowest standard roads within the FLHP and also constitute the most mileage. These roads are open to the public at the discretion of the Forest Service. Funding for construction, reconstruction, and maintenance of these roads is usually through a commercial resource activity using the road or agency appropriated funds.

Alaska's share of the FLHP funds is small and typically used for construction of roads built to a much lower standard than that proposed for the Bradfield/Iskut transportation corridor. It is a possibility that these funds could be used for a portion of the design and/or development of the road.

## **GARVEE**

The National Highway System Designation Act of 1995 revised the Title 23 provisions relating to bond issue projects, section 122. The revised section makes debt financing costs relating to Title 23 projects eligible for Federal reimbursement. These bonds are generally referred to as GARVEE bonds (Grant Anticipation Revenue Vehicles). These are state bonds which may be repaid with future federal funds and state match.

The project must be approved as a Federal-aid debt-financed (bond, certificate, note, or other debt instrument) project in order to receive payments for eligible debt-related costs under section 122. Once a project is selected for bond financing, the project is submitted to the responsible FHWA Division Office for approval as an advance construction (AC) project under section 115 of Title 23. The AC designation will ensure that the project follows Federal-aid procedures and will preserve the eligibility to reimburse debt-related costs through future Federal-aid fund obligations.

## **Public Lands Highway Discretionary Program**

The Public Lands Highway (PLH) program was originally established in 1930 by the amendment relative to the construction of roads through public lands and federal reservations. Funding was provided from the General Fund of the Treasury. The intent of the program is to improve access to and within Federal lands of the nation. The Federal Highway Act of 1970 changed the funding source for the program from the General Fund to the Highway Trust Fund, effective in FY 1972. The program has been continued with each highway or transportation act since then, and the latest transportation act, the Transportation Equity Act for the 21<sup>st</sup> Century (TEA 21 Public Law 105-178), continues the program through FY 2003. Annual funding for the 1999 through 2003 was \$83.6 million.

This is a nationwide competitive program. Eligible projects are on roads that are in or adjacent to federal lands. The funds are allocated "among those states having unappropriated or unreserved public lands, nontaxable Indian lands or other Federal reservations, on the basis of need of such States." Since all the states have some Federal lands, all are eligible for PLH discretionary funding. These funds are a potential source for the Bradfield/Iskut transportation corridor. The federal share is 100 percent.

## **Denali Commission**

Introduced by Congress in 1998, the Denali Commission is an innovative federal-state partnership designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities.

In the Denali Commission Act of 1998, the Commission was directed "To promote rural development, provide power generation and transmission facilities, modern communication systems, water and sewer systems and other infrastructure needs."

The Commission considers "rural" as any community that experiences the following three criteria:

- The difficulty and cost of importing and exporting products, traveling to, and communicating with, urban centers because of distance;
- The absence of, or inadequate public infrastructure;
- A "one industry" village/community with a small population located in proximity to a natural resource and having cheap labor.

The focus of Denali Commission funding has previously been on health care, energy, and bulk fuel projects in rural communities. However, in its broadest sense, the Bradfield/Iskut transportation corridor meets the three criteria as defined by the Commission and could also be a source of funding for this project.

## **Coordinated Border Infrastructure Program (CORBOR)**

Funding is available for coordinated planning, design, and construction of high priority corridors and other significant corridors for the movement of freight and to improve the safe movement of people and goods at or across the border between the United States and Canada and the border between the United States and Mexico. The federal ratio is 90.97 percent.

The genesis of the program is in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Section 1105 of the ISTEA defined 21 high priority corridors and provided both earmarked and discretionary funding for corridor programs. Over the years, there was an obvious trend from awards based on US DOT selection toward awards based completely on Congressional designation. In FY 1999, the US DOT made all award selections. In FY 2002 and FY 2003 all awards were based on Congressional designation. In FY 2003 \$255 million in transportation funds were awarded.

## **SHAKWAK Agreement**

Shakwak is a special category of funds that may be used for the reconstruction of the Haines Highway and for the vessels and terminals of the Alaska Marine Highway System. The federal share is 100 percent. The Shakwak Agreement, between the United States and Canadian governments, provides for reconstruction of the North Alaska Highway and the Haines Road. The agreement, drafted in 1997, assigns responsibility for design and construction of the Shakwak project to the Yukon

government. Because the Alaska Highway was initially constructed with great haste during war time, and 85 percent of highway traffic is U.S. traffic, the U.S. government agreed to pay the Canadian government to improve the road to a modern two-lane 100-km/hr standard. Road construction is expected to be complete in 2004. Funds from this agreement could be diverted, reallocated, or reappropriated to a Bradfield Canal connection to the Cassiar Highway.

## **Congressional Funding**

Transportation infrastructure is typically funded through the normal highway funding formula for all states. However, federal grants may be appropriated through other avenues for projects deemed important to the state. Priority funding for special projects may be included in other Congressional bills as part of the political process. One such designation is the High Priority (HIPRI) projects. In TEA-21, Section 1602, Congress earmarked funds for over 1,800 projects in many states. Alaska received over \$68 million for sixteen projects. These funds are not available for other projects. The federal share is 80 percent.

## **Combination Funding**

For large scale projects such as the Bradfield/Iskut transportation corridor, it is common to seek funding from multiple sources. A combination of any of the previously mentioned funding sources or in combination with Canadian sources or the private sector may be the answer to developing this project.

## **Private Sector**

While unlikely, it is not uncommon for a private company to build roads for major projects. At this time, there are no identified U.S. companies that might be interested in pursuing such action, though the possibility of a Canadian mining company contributing to the road construction exists.

## **BC Options**

There are a number of funding methods used within the province to manage, own and operate roads within BC. These include various provincial ministries, private industrial companies and private companies operating toll roads.

There are at least two mines that could benefit from portions of the road along with potential forestry and hydro operations. In the future, other forestry operators and mines may take advantage of the road to improve the feasibility of their prospects. However, currently there is no specific industrial sponsor that would be interested in the entire length of the road. Therefore, the road could not be privately sponsored under existing mining or forestry legislation, and it is unlikely that there would be any interest in operating the road as a toll road or under a Public Private Partnership. The road best lends itself to implementation as a project of a provincial ministry.

The preferred body to manage, own and operate the road in BC would be the provincial Ministry of Transportation. The Canadian portion of the road would be operated as a provincial highway. There are several reasons for this approach:

- The primary purpose of the road would be to connect the communities in the southern portion of the Alaskan panhandle to the rest of North America, thereby providing much easier and cheaper interregional and international travel for industrial, commercial and tourist traffic.
- The US portion will be built by either Federal or State highways bodies and the Ministry of Transportation would be their Canadian counterpart.
- There are already established working relationships between these agencies dealing with issues involving the Alaska Highway and every other highway that crosses the international border.

Most of the highway work in BC is funded by the provincial government, with the Canadian government providing partial funding for some select routes such as the Okanogan area. Highway 37 N, which the Bradfield / Iskut road would connect to, has recently had some significant upgrades, all of which have been funded by the provincial government. Therefore it is unlikely that any funding would be available from the Canadian government.

The Alaska Highway would provide a good starting point for issues relating to the road such as funding, design standards, road maintenance standards and funding, and load limits – especially during spring thaw. For the road to be a successful cooperative venture, the affected communities on both sides of the border would need to be stakeholders in road-related issues.

## **Summary**

The Southeast Alaska Transportation Plan indicates that highway construction outlined in the plan will be funded primarily (89 percent) by Federal Earmark, with much smaller contributions by Statewide Transportation Improvement Program (STIP) funding (6 percent) and Forest Highway Program funding (5 percent). Ferry Program funding will also come primarily from Federal Earmark (62 percent), and also include STIP money (31 percent) and Inter-island Ferry Authority (IFA) funding (7 percent). Ferry terminals will be funding primarily by STIP money (61 percent), as well as Federal Earmark (31 percent) and IFA money (8 percent).

Because of the relatively high cost of constructing the Bradfield/Iskut Corridor, Federal Earmark is likely the only reasonable expectation for funding, though perhaps with some minor contributions from the Forest Highway Program or STIP funds.

Canadian participation is uncertain, and would likely be available only with a clear demonstration of the economic benefits for Canada.

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